Table 4-3
SEDIMENT CHEMISTRY RESULTS / SMS COMPARISON

Sample ID	Marine Sediment Standards		NFK UPRIV1		NFK UPRIV2		NFK001		NFK002		NFK003	
Laboratory ID			L4321-23		L4321-24		L4321-1		L4321-2		L4321-3	
Sample Depth (cm)			0-10		0-10		0-10		0-10		0-10	
Sample Date			8/19/94		8/19/94		8/18/94		8/18/94		8/18/94	
	SQS	CSL	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.
LPAH (mg/Kg-Organic Carbon)	370	780	7.51		75.6	U	9.74		8.54		6.88	
Naphthalene	99	170	4.81	U	75.6	U	4.37	U	5.04	U	4.89	U
Acenaphthylene	66	66	1.77	U	28.1	U	1.62	U	1.9	U	1.8	U
Acenaphthene	16	57	1.22	U	* 19.3	U	1.14	U	1.31	U	1.22	U
Fluorene	23	79	1.77	U	* 28.1	U	1.62	U	1.9	U	1.8	U
Phenanthrene	100	480	7.51	G	28.1	UG	7.84	G	8.54	G	6.88	G
Anthracene	220	1200	1.77	U	28.1	U	1.9	G	1.9	U	1.8	UG
2-Methylnaphthalene	38	64	4.81	U	** 75.6	U	4.37	U	5.04	U	4.89	U
HPAH (mg/Kg-Organic Carbon)	960	5300	76.7		75.6	U	86.6		109		83.8	
Fluoranthene	160	1200	17.2		28.1	U	15.9	G	20.9		19.9	G
Pyrene	1000	1400	15.4	G	28.1	UG	17.8	G	20.3	G	18.5	G
Benzo(a)anthracene	110	270	5.8		28.1	U	7.54	G	8.32		6.93	G
Chrysene	110	460	8.9		28.1	U	9.88		10.3		9.5	
Total Benzofluoranthenes	230	450	9.34		75.6	U	16.4		20		18.6	
Benzo(b)fluoranthene			9.34		75.6	U	9.82		14		12.6	
Benzo(k)fluoranthene			4.81	UL	75.6	UL	6.6	J	6.1	L	6	J
Benzo(a)pyrene	99	210	6.8	X	47.4	UX	6.35	G	9.05	X	7.12	G
Indeno(1,2,3-Cd)Pyrene	34	88	7.13		* 47.4	U	7.13	G	10.1		3.2	G
Dibenzo(a,h)anthracene	12	33	4.81	U	** 75.6	U	4.37	UG	5.04	U	4.89	UG
Benzo(g,h,i)perylene	31	78	6.1	G	* 47.4	UG	5.57	G	10.5	G	3.09	UG
Other Nonionizable Organics (mg/Kg-Organic Carbon)												
1,2-Dichlorobenzene	2.3	2.3	0.144	UBEG	2.22	UBEG	0.132	UEG	0.153	UBEG	0.151	UEG
1,4-Dichlorobenzene	3.1	9	0.144	UBEG	2.22	UBEG	0.281	BEG	1.38	BEG	2.34	BEG
1,2,4-Trichlorobenzene	0.81	1.8	0.144	UEG	** 2.22	UEG	0.132	UEG	0.153	UEG	0.151	UEG
Hexachlorobenzene	0.38	2.3	0.144	UEG	* 2.22	UEG	0.132	UEG	0.153	UEG	0.151	UEG
Diethyl Phthalate	61	110	2.98	U	47.4	U	2.75	U	3.14	U	3.09	U
Dimethyl Phthalate	53	53	1.22	U	19	U	1.14	U	1.31	U	1.22	U
Di-N-Butyl Phthalate	220	1700	6.13	BG	116	BG	6.65	B	8.61	BG	9.5	B
Benzyl Butyl Phthalate	4.9	64	1.77	U	* 28.1	U	1.62	U	1.9	U	1.8	U
Bis(2-Ethylhexyl)Phthalate	47	78	16.9		37		15		31.3	B	30.7	
Di-N-Octyl Phthalate	58	4500	1.77	UL	28.1	UL	1.62	UL	1.9	UL	1.8	UL
Dibenzofuran	15	58	2.98	U	* 47.4	U	2.75	U	3.14	U	3.09	U
Hexachlorobutadiene	3.9	6.2	2.98	U	** 47.4	U	2.75	UG	3.14	U	3.09	UG
N-Nitrosodiphenylamine	11	11	2.98	U	** 47.4	U	2.75	U	3.14	U	3.09	U
Total PCBs	12	65	1.44	U	* 22.2	U	19.4		1.53	U	1.51	U
Ionizable Organics (ug/Kg-Dry Weight)												
Phenol	420	1200	220	U	130	U	190	U	180	U	170	U
2-Methylphenol	63	63	54	U	32	U	46	U	43	U	43	U
4-Methylphenol	670	670	54	U	32	U	46	U	43	U	43	U
2,4-Dimethylphenol	29	29	** 54.0	U	** 32.0	U	** 46.0	U	** 43.0	U	** 43.0	U
Pentachlorophenol	360	690	54	U	32	U	46	U	43	U	43	U
Benzyl Alcohol	57	73	54	U	32	U	46	U	43	U	43	U
Benzoic Acid	650	650	220	U	130	U	190	U	180	U	170	U
Metals (mg/Kg-Dry Weight)												
Arsenic, Total	57	93	22	J	11	J	19	J	18	J	17	J
Cadmium, Total	5.1	6.7	0.6	U	0.35	U	0.51	U	0.48	U	0.46	U
Chromium, Total	260	270	26.6		12.6		25.1		24.8		32.7	
Copper, Total	390	390	27.8		12.1		31		26.9		29	
Lead, Total	450	530	17	J	4.9	J	17	J	13	J	13	J
Mercury, Total	0.41	0.59	0.08	J	0.035	J	0.1	JE	0.078	JE	0.21	JE
Silver, Total	6.1	6.1	0.8	U	0.46	U	0.68	U	0.64	U	0.62	U
Zinc, Total	410	960	80.3		50		77.8		68		71.7	
Conventionals												
% TOC			1.81		0.0676		1.67		1.37		1.39	
Acid Volatile Sulfides (mg/Kg)			420	E	40	UE	220	E	750	E	770	E
Gravel (%)			0.2		5.6		0.2		0.6		0.2	
Sand (%)			64.1		92		48.3		46.9		49.9	
Silt (%)			33.3		3		46.9		38.6		39.6	
Clay (%)			3.5		0.3		4.8		14.3		10.4	
Fines (%)			36.8		3.3		51.7		52.9		50	
Salinity (ppt)			14		17				16			
% Solids			49.7		84		59		62.5		63	

Table 4-3
SEDIMENT CHEMISTRY RESULTS / SMS COMPARISON

Sample ID	Marine Sediment Standards		NFK004		NFK004A		NFK005		NFK006		NFK007	
Laboratory ID			L4321-4		L4384-1		L4321-5		L4321-6		L4321-7	
Sample Depth (cm)			0-10		0-10		0-10		0-10		0-10	
Sample Date			8/18/94		8/22/94		8/18/94		8/18/94		8/22/94	
	SQS	CSL	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.
LPAH (mg/Kg-Organic Carbon)	370	780	21		33.1		41.2		179		3.8	
Naphthalene	99	170	4.65	U	2.74	U			5.62	UG	3.12	U
Acenaphthylene	66	66	1.74	U	1.05	U	1.6	U	2.1	U	1.16	U
Acenaphthene	16	57	1.16	U	1.3		3.45		11.2		0.809	U
Fluorene	23	79	1.74	U	1.6	J	3.33		10.7		1.16	U
Phenanthrene	100	480	19	G	26.2	G	27.5	G	141	G	3.8	G
Anthracene	220	1200	2.4	G	4.01		6.93		15.8	G	1.16	UG
2-Methylnaphthalene	38	64	4.65	U	2.74	U	4.27	U	5.62	U	3.12	U
HPAH (mg/Kg-Organic Carbon)	960	5300	195		258		421		575		46	
Fluoranthene	160	1200	37.5	G	55.6		114		94.8	G	9.6	G
Pyrene	1000	1400	34.3	G	43.1	G	94	G	100	G	7.8	G
Benzo(a)anthracene	110	270	15.2	G	21.9		35.4		47.7	G	3.6	G
Chrysene	110	460	20		30.9		37.1		49		4.94	G
Total Benzofluoranthenes	230	450	35.7		56.7		59.6		121		9.04	
Benzo(b)fluoranthene			24.7		40.4		41.7		88.2		5.84	G
Benzo(k)fluoranthene			11		16.3	L	17.9	L	32.9		3.2	JG
Benzo(a)pyrene	99	210	15	G	24.5	X	28	X	72.3	G	3.4	JG
Indeno(1,2,3-Cd)Pyrene	34	88	18.1	G	12.5		25.8		42.8	G	5.18	G
Dibenzo(a,h)anthracene	12	33	5.5	G	3.2		6.5		17.6	G	3.12	UG
Benzo(g,h,i)perylene	31	78	13.9	G	9.8	G	21	G	29.3	G	2.4	JG
Other Nonionizable Organics (mg/Kg-Organic Carbon)												
1,2-Dichlorobenzene	2.3	2.3	0.142	UEG	0.0848	UBEG	0.127	UBEG	0.171	UEG	0.0925	U
1,4-Dichlorobenzene	3.1	9	3.28	BEG	1.61	BEG	2.37	BEG	0.17	BEG	0.0925	U
1,2,4-Trichlorobenzene	0.81	1.8	0.142	UEG	0.0848	UEG	0.127	UEG	0.171	UEG	0.0925	U
Hexachlorobenzene	0.38	2.3	0.142	UEG	0.0848	UEG	0.127	UEG	0.171	UEG	0.0925	U
Diethyl Phthalate	61	110	2.9	U	1.8	U	2.67	U	3.52	U	1.97	U
Dimethyl Phthalate	53	53	1.16	U	0.723	U	1.07	U	1.43	U	0.809	U
Di-N-Butyl Phthalate	220	1700	9.48	B	2	BG	6.73	BG	10.8	B	4.16	B
Benzyl Butyl Phthalate	4.9	64	3.88		3.57		3.99		2.2	J	1.16	U
Bis(2-Ethylhexyl)Phthalate	47	78	33.8		85.3		70.0	B	16.8		12	
Di-N-Octyl Phthalate	58	4500	1.74	UL	1.05	UL	1.6	UL	2.1	UL	1.16	U
Dibenzofuran	15	58	2.9	U	1.8	U			3.5	J	1.97	U
Hexachlorobutadiene	3.9	6.2	2.9	UG	1.8	U	2.67	U	3.52	UG	1.97	U
N-Nitrosodiphenylamine	11	11	3	J	1.8	U	2.67	U	3.52	U	1.97	U
Total PCBs	12	65	4.4		9.32		8.97		9.07		5.84	
Ionizable Organics (ug/Kg-Dry Weight)												
Phenol	420	1200	180	U	290	U	160	U	150	U	140	U
2-Methylphenol	63	63	45	U	** 72.0	U	40	U	37	U	34	U
4-Methylphenol	670	670	45	U	72	U	280		37	U	34	U
2,4-Dimethylphenol	29	29	** 45.0	U	** 72.0	U	** 40.0	U	** 37.0	U	** 34.0	U
Pentachlorophenol	360	690	45	U	72	U	40	U	37	U	34	UG
Benzyl Alcohol	57	73	45	U	* 72.0	U	40	U	37	U	34	U
Benzoic Acid	650	650	180	U	290	U	160	U	150	U	150	J
Metals (mg/Kg-Dry Weight)												
Arsenic, Total	57	93	20	J	24	J	16	J	51.3		6.3	U
Cadmium, Total	5.1	6.7	0.5	U	0.8	U	0.45	U	0.41	U	0.38	U
Chromium, Total	260	270	26		34.2		24.1		22.4		17.9	
Copper, Total	390	390	31.4		56.2		34.1		42		22.6	
Lead, Total	450	530	20	J	43		27.8		58		14	J
Mercury, Total	0.41	0.59	0.088	JE	0.18	J	0.12	JE	0.053	JE	0.072	JE
Silver, Total	6.1	6.1	0.67	U	1.1	U	0.67	J	0.53	U	0.53	J
Zinc, Total	410	960	83.9		184		92.7		138		55.2	
Conventionals												
% TOC			1.55		4.01		1.5		1.05		1.73	
Acid Volatile Sulfides (mg/Kg)			1500	E	1800	E	640	E	40	UE	1200	E
Gravel (%)			1		0.2		4		30		0.2	
Sand (%)			57.6		33.4		61.3		50.4		40	
Silt (%)			29.4		43.4		30.9		15.8		52.9	
Clay (%)			11.7		23.1		3.6		4.1		7.2	
Fines (%)			41.1		66.5		34.5		19.9		60.1	
Salinity (ppt)			15		8							
% Solids			60.1		37.7		67.2		73.1		79.3	

Table 4-3
SEDIMENT CHEMISTRY RESULTS / SMS COMPARISON

Sample ID / Laboratory ID / Sample Depth (cm) / Sample Date	Marine Sediment Standards		NFK008 L4321-8 0-10 8/17/94		NFK008 L6725-26 0-30 8/28/95		NFK008 L6725-27 30-60 8/28/95		NFK008 L6725-28 60-90 8/28/95		NFK008 L6725-29 90-120 8/28/95	
	SQS	CSL	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.
LPAH (mg/Kg-Organic Carbon)	370	780	15.8		11.7		9.19		124	U	190	U
Naphthalene	99	170	5.26	U	3.53	UG	3.3	UG	* 124	UG	** 190	UG
Acenaphthylene	66	66	1.92	U	1.3	UG	1.21	UG	47	U	** 69.3	U
Acenaphthene	16	57	1.35	U	0.93	UG	0.825	UG	* 32.2	U	* 47.4	U
Fluorene	23	79	1.92	U	1.3	UG	1.3	JG	* 47	U	* 69.3	U
Phenanthrene	100	480	13.5		9.63	G	6.89	G	47	UG	69.3	UG
Anthracene	220	1200	2.3	JG	2.1	JG	1	JG	47	UG	69.3	UG
2-Methylnaphthalene	38	64	5.26	U	3.53	UG	3.3	UG	** 124	UG	** 190	UG
HPAH (mg/Kg-Organic Carbon)	960	5300	160		95.4		67.1		124	U	190	U
Fluoranthene	160	1200	31.6		24.2	G	14.7	G	47	UG	69.3	UG
Pyrene	1000	1400	29.8		14.6	G	9.42	G	47	UG	69.3	UG
Benzo(a)anthracene	110	270	13.1		7.95	G	5	G	47	UG	69.3	UG
Chrysene	110	460	17.2		9.16	G	7.62	G	47	UG	69.3	UG
Total Benzofluoranthenes	230	450	33.3		15.9		13.4		124	U	190	U
Benzo(b)fluoranthene			21		11.8	G	8.79	G	124	UG	190	UG
Benzo(k)fluoranthene			12.3	L	4.1	JG	4.6	JG	124	UG	190	UG
Benzo(a)pyrene	99	210	15.4	L	8.23	G	6.3	G	76.7	UG	* 120	UG
Indeno(1,2,3-Cd)Pyrene	34	88	11.9	G	8.14	G	5.87	G	* 76.7	UG	** 120	UG
Dibenzo(a,h)anthracene	12	33	5.26	U	3.53	UG	3.3	UG	** 124	U	** 190	U
Benzo(g,h,i)perylene	31	78	7.5	G	7.26	G	4.82	G	* 76.7	UG	** 120	UG
Other Nonionizable Organics (mg/Kg-Organic Carbon)												
1,2-Dichlorobenzene	2.3	2.3	0.17	JEG	0.0558	UG	0.0534	UG	1.98	UG	2	U
1,4-Dichlorobenzene	3.1	9	1.74	E,G	0.963	G	1.18	G	** 9.18	G	** 15.1	G
1,2,4-Trichlorobenzene	0.81	1.8	0.16	UEG	* 1.30	UG	* 1.21	UG	** 47	UG	** 69.3	UG
Hexachlorobenzene	0.38	2.3	0.16	UEG	0.0558	UG	0.0534	UG	* 1.98	UG	* 2	U
Diethyl Phthalate	61	110	3.27	U	2.23	UG	2.09	UG	* 76.7	U	** 120	U
Dimethyl Phthalate	53	53	1.35	U	0.93	UG	0.825	UG	32.2	U	47.4	U
Di-N-Butyl Phthalate	220	1700	7.31	G,B	6.56	BG	9.03	BG	76.7	U,B	120	U,B
Benzyl Butyl Phthalate	4.9	64	1.92	UB	1.3	UG	1.21	UG	* 47	U	** 69.3	U
Bis(2-Ethylhexyl)Phthalate	47	78	** 140	B	28	G	23	G	47	U	* 69.3	U
Di-N-Octyl Phthalate	58	4500	1.92	UL	1.3	UG	1.21	UG	47	U	* 69.3	U
Dibenzofuran	15	58	3.27	U	2.23	UG	2.09	UG	** 76.7	U	** 120	U
Hexachlorobutadiene	3.9	6.2	3.27	U	2.23	UG	2.09	UG	** 76.7	UG	** 120	UG
N-Nitrosodiphenylamine	11	11	4	J	2.23	U,B,G	2.5	J,B,G	** 76.7	U,B	** 120	U,B
Total PCBs	12	65	** 135		** 22.5		** 3950		** 119		* 58.4	U
Ionizable Organics (ug/Kg-Dry Weight)												
Phenol	420	1200	210	U	200	U	170	U	130	U	130	U
2-Methylphenol	63	63	51	U	48	U	43	U	31	U	33	U
4-Methylphenol	670	670	51	U	48	U	43	U	31	U	33	U
2,4-Dimethylphenol	29	29	** 51.0	U	** 48.0	UG	** 43.0	UG	** 31.0	UG	** 33.0	UG
Pentachlorophenol	360	690	51	U	48	U	43	U	31	U	33	U
Benzyl Alcohol	57	73	51	U	48	UG	43	UG	31	UG	33	UG
Benzoic Acid	650	650	210	U	349	E	210	JE	130	UE	130	UE
Metals (mg/Kg-Dry Weight)												
Arsenic, Total	57	93	21	J	7.6	U	7.8	U	5.5	U	5.7	U
Cadmium, Total	5.1	6.7	0.57	U	0.53	J	0.9	J	0.32	U	0.34	U
Chromium, Total	260	270	27.5		24.6		25.2		12.4		13	
Copper, Total	390	390	31.5		34		36.8		12.2		10.1	
Lead, Total	450	530	28	J	21	J	28.4		3.2	U	3.4	U
Mercury, Total	0.41	0.59	** 0.841	E	0.1	J	** 37.1		0.046	J	0.03	J
Silver, Total	6.1	6.1	0.76	U	0.87	J	0.95	J	0.43	U	0.45	U
Zinc, Total	410	960	98.7		99.3		98.1		32.8		27.1	
Conventionals												
% TOC			1.56		2.15		2.06		0.0404		0.0274	
Acid Volatile Sulfides (mg/Kg)			480	E								
Gravel (%)			0.2		0.2		4.7		2.7		0.2	
Sand (%)			55.4		51		55.7		91.6		95.9	
Silt (%)			31.7		48		37.5		5.7		3.8	
Clay (%)			12.8		1.2		2		0.3		0.3	
Fines (%)			44.5		49.2		39.5		6		4.1	
Salinity (ppt)												
% Solids			52.7		56.4		63		86.2		82.9	

Table 4-3
SEDIMENT CHEMISTRY RESULTS / SMS COMPARISON

Sample ID	Marine Sediment Standards		NFK009		NFK009		NFK009		NFK009		NFK009	
Laboratory ID			L4321-25		L4321-26		L4321-27		L4321-28		L4321-9	
Sample Depth (cm)			0-15		15-30		30-45		45-60		0-10	
Sample Date			8/31/94		8/31/94		8/31/94		8/31/94		8/17/94	
	SQS	CSL	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.
LPAH (mg/Kg-Organic Carbon)	370	780	80.8		27.8		73.1		5.1		27.5	
Naphthalene	99	170	3.73	U	2.78	UE	9.07	U	9.72	U	4.54	U
Acenaphthylene	66	66	1.4	U	1.01	UE	3.38	U	3.67	U	1.7	U
Acenaphthene	16	57	6.66		2.6	E	5.12		2.57	U	2.1	J
Fluorene	23	79	5.91		1.3	E	4	J	3.67	U	2.1	J
Phenanthrene	100	480	55.7	G	19	GE	53.6	G	5.1	G	20	
Anthracene	220	1200	12.5		4.9	E	10.4		3.67	U	3.33	G
2-Methylnaphthalene	38	64	3.73	U	2.78	UE	9.07	U	9.72	U	4.54	U
HPAH (mg/Kg-Organic Carbon)	960	5300	369		118		365		104		214	
Fluoranthene	160	1200	85.3		29.6	E	87.7		21.7		47.1	
Pyrene	1000	1400	65	G	24	GE	65.7	G	24.6	G	39.1	
Benzo(a)anthracene	110	270	34.9		11.5	E	33.3		11.4		17.5	
Chrysene	110	460	41.4		12.3	E	40.4		11.5		20.9	
Total Benzofluoranthenes	230	450	84.3		22.7		78.3		12		40.4	
Benzo(b)fluoranthene			57.1		16.1	E	55.7		12	J	30.7	
Benzo(k)fluoranthene			27.2	L	6.6	LE	22.6	L	9.72	UL	9.69	L
Benzo(a)pyrene	99	210	37	X	11.5	XE	34.9	X	8.8	X	17.1	L
Indeno(1,2,3-Cd)Pyrene	34	88	12.1		3.79	E	13.4		7	J	15	G
Dibenzo(a,h)anthracene	12	33	3.73	U	2.78	UE	9.07	U	9.72	U	5	J
Benzo(g,h,i)perylene	31	78	8.73	G	2.9	GE	11	G	6.8	G	11.7	G
Other Nonionizable Organics (mg/Kg-Organic Carbon)												
1,2-Dichlorobenzene	2.3	2.3	0.11	UBEG	0.12	BEG	0.34	BEG	0.294	UBEG	0.15	JEG
1,4-Dichlorobenzene	3.1	9	** 34.7	BEG	** 71.2	BEG	** 489	BEG	** 102	BEG	** 10.5	E,G
1,2,4-Trichlorobenzene	0.81	1.8	0.11	UEG	0.0859	UEG	0.267	UEG	0.294	UEG	0.139	UEG
Hexachlorobenzene	0.38	2.3	0.11	UEG	0.0859	UEG	0.267	UEG	0.294	UEG	0.139	UEG
Diethyl Phthalate	61	110	2.33	U	1.72	UE	5.69	U	6.06	U	2.84	U
Dimethyl Phthalate	53	53	0.93	U	0.707	UE	2.3	U	2.57	U	1.13	U
Di-N-Butyl Phthalate	220	1700	6.64	BG	3.7	BGE	14	BG	7.7	BG	7.53	G,B
Benzyl Butyl Phthalate	4.9	64	* 6.25		1.01	UE	3.38	U	* 17.0		1.9	B
Bis(2-Ethylhexyl)Phthalate	47	78	** 86.0		19.9	E	** 149		25		** 253	B
Di-N-Octyl Phthalate	58	4500	1.4	UL	1.01	ULE	3.38	UL	3.67	UL	1.7	UL
Dibenzofuran	15	58	2.33	U	1.72	UE	5.69	U	6.06	U	2.84	U
Hexachlorobutadiene	3.9	6.2	2.33	U	1.72	UE	* 5.69	U	* 6.06	U	2.84	U
N-Nitrosodiphenylamine	11	11	8.13		5.86	E	5.69	U	6.06	U	5	J
Total PCBs	12	65	1.1	U	* 14.7		2.67	U	10.6		* 33.3	
Ionizable Organics (ug/Kg-Dry Weight)												
Phenol	420	1200	140	U	140	UE	130	U	140	U	220	U
2-Methylphenol	63	63	35	U	34	UE	32	U	33	U	55	U
4-Methylphenol	670	670	35	U	34	UE	32	U	33	U	55	U
2,4-Dimethylphenol	29	29	** 35.0	U	** 34.0	UE	** 32.0	U	** 33.0	U	** 55.0	U
Pentachlorophenol	360	690	35	U	34	UE	32	U	33	U	55	U
Benzyl Alcohol	57	73	35	U	34	UE	32	U	33	U	55	U
Benzoic Acid	650	650	140	U	140	UE	130	U	140	U	220	U
Metals (mg/Kg-Dry Weight)												
Arsenic, Total	57	93	12	JE	14	JE	13	JE	8	JE	22	J
Cadmium, Total	5.1	6.7	0.96	J	1.2	J	0.54	J	0.37	U	0.59	U
Chromium, Total	260	270	21.8		28.8		19.9		13.4		25.2	
Copper, Total	390	390	125	GE	133	GE	104	GE	22.4	GE	60.9	
Lead, Total	450	530	52.6	LE	62.3	LE	38	LE	7.1	JLE	68.1	
Mercury, Total	0.41	0.59	0.21	J	** 0.853		0.11	J	0.029	J	0.13	JE
Silver, Total	6.1	6.1	0.51	U	0.52	J	0.49	J	0.48	U	0.8	U
Zinc, Total	410	960	345	GE	240	GE	163	GE	44.6	GE	140	
Conventionals												
% TOC			1.5		1.98		0.562		0.545		1.94	
Acid Volatile Sulfides (mg/Kg)			1100	E	1400	E	410	E	140	E	1500	E
Gravel (%)			33.8		28.7		15.3		2.8		10.4	
Sand (%)			55.6		58		77.2		93.2		53.5	
Silt (%)			8.2		12.6		7.9		4		26.7	
Clay (%)			1.6		1.5		0.9		0.4		10.1	
Fines (%)			9.8		14.1		8.8		4.4		36.8	
Salinity (ppt)											13	
% Solids			76.2		78.7		84		81.4		48.9	

Table 4-3
SEDIMENT CHEMISTRY RESULTS / SMS COMPARISON

Sample ID / Laboratory ID / Sample Depth (cm) / Sample Date	Marine Sediment Standards		NFK009 L6725-17 0-30 8/28/95		NFK009 L6725-18 30-60 8/28/95		NFK009 L6725-19 60-90 8/28/95		NFK009 L6725-20 90-120 8/28/95		NFK009 FD L4321-10 0-10 8/17/94	
	SQS	CSL	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.
LPAH (mg/Kg-Organic Carbon)	370	780	37.1		20.1	U	73	U	161	U	16.6	
Naphthalene	99	170	8.28	UG	20.1	UG	73	UG	* 161	UG	4.77	U
Acenaphthylene	66	66	3.05	U	7.53	U	26.8	U	58.2	U	1.78	U
Acenaphthene	16	57	2.18	U	5.02	U	* 19.4	U	* 41.1	U	1.21	U
Fluorene	23	79	3.1	J	7.53	U	* 26.8	U	* 58.2	U	1.78	U
Phenanthrene	100	480	25.9	G	7.53	UG	26.8	UG	58.2	UG	14.1	
Anthracene	220	1200	8.1	G	7.53	UG	26.8	UG	58.2	UG	2.5	JG
2-Methylnaphthalene	38	64	8.28	UG	20.1	UG	** 73	UG	** 161	UG	4.77	U
HPAH (mg/Kg-Organic Carbon)	960	5300	271		20.1	U	73	U	161	U	196	
Fluoranthene	160	1200	60	G	7.53	UG	26.8	UG	58.2	UG	37.4	
Pyrene	1000	1400	41.1	G	7.53	UG	26.8	UG	58.2	UG	39.1	
Benzo(a)anthracene	110	270	25.3	G	7.53	UG	26.8	UG	58.2	UG	15.9	
Chrysene	110	460	33.6	G	7.53	UG	26.8	UG	58.2	UG	19.2	
Total Benzofluoranthenes	230	450	54.4		20.1	U	73	U	161	U	35	
Benzo(b)fluoranthene			38.4	G	20.1	UG	73	UG	161	UG	26.4	
Benzo(k)fluoranthene			16	G	20.1	UG	73	UG	161	UG	8.6	JL
Benzo(a)pyrene	99	210	20.5	G	12.6	UG	46.2	UG	99	UG	15.7	L
Indeno(1,2,3-Cd)Pyrene	34	88	19.9	G	12.6	UG	* 46.2	UG	** 99	UG	19.1	G
Dibenzo(a,h)anthracene	12	33	8.28	U	* 20.1	U	** 73	U	** 161	U	4.77	U
Benzo(g,h,i)perylene	31	78	15.8	G	12.6	UG	* 46.2	UG	** 99	UG	14.7	G
Other Nonionizable Organics (mg/Kg-Organic Carbon)												
1,2-Dichlorobenzene	2.3	2.3	0.132	UG	0.318	UG	1.16	UG	** 2.57	UG	0.144	UEG
1,4-Dichlorobenzene	3.1	9	** 11.6	G	** 38.2	G	** 24.1	G	** 90.4	G	** 11.8	E,G
1,2,4-Trichlorobenzene	0.81	1.8	** 3.05	UG	** 7.53	UG	** 26.8	UG	** 58.2	UG	0.144	UEG
Hexachlorobenzene	0.38	2.3	0.132	U	0.318	U	* 1.16	UG	** 2.57	U	0.144	UEG
Diethyl Phthalate	61	110	5.23	U	12.6	U	46.2	U	* 99	U	2.99	U
Dimethyl Phthalate	53	53	2.18	U	5.02	U	19.4	U	41.1	U	1.6	J
Di-N-Butyl Phthalate	220	1700	17.3	B	28.2	B	125	B	99	U,B	5.2	G,B
Benzyl Butyl Phthalate	4.9	64	3.05	U	* 7.53	U	* 26.8	U	* 58.2	U	1.78	U,B
Bis(2-Ethylhexyl)Phthalate	47	78	** 83.1		12	J	34	J	** 92	J	45.5	B
Di-N-Octyl Phthalate	58	4500	3.05	U	7.53	U	26.8	U	* 58.2	U	1.78	UL
Dibenzofuran	16	58	5.23	U	12.6	U	* 46.2	U	** 99	U	2.99	U
Hexachlorobutadiene	3.9	6.2	* 5.23	UG	** 12.6	UG	** 46.2	UG	** 99	UG	2.99	U
N-Nitrosodiphenylamine	11	11	5.23	U,B	** 12.6	U,B	** 46.2	U,B	** 99	U,B	2.99	U
Total PCBs	12	65	** 36.2		5.86	U	* 22.4	U	* 47.9	U	9.42	
Ionizable Organics (ug/Kg-Dry Weight)												
Phenol	420	1200	150	U	120	U	130	UG	120	U	210	U
2-Methylphenol	63	63	36	U	30	U	31	UG	29	U	52	U
4-Methylphenol	670	670	36	U	30	U	31	UG	29	U	52	U
2,4-Dimethylphenol	29	29	** 36.0	UG	** 30.0	UG	** 31.0	UG	29	UG	** 52.0	U
Pentachlorophenol	360	690	36	U	30	U	31	UG	29	U	52	U
Benzyl Alcohol	57	73	36	UG	30	UG	31	UG	29	UG	52	U
Benzoic Acid	650	650	225	E	120	UE	130	UEG	120	UE	210	U
Metals (mg/Kg-Dry Weight)												
Arsenic, Total	57	93	6.9	J	5.3	U	5.3	U	5.2	U	19	J
Cadmium, Total	5.1	6.7	0.48	J	0.32	U	0.32	U	0.32	U	0.58	U
Chromium, Total	260	270	23.2		13.1		14.4		12.9		26.3	
Copper, Total	390	390	62.9		13.7		13		10.4		39.2	
Lead, Total	450	530	123		3.2	U	3.2	U	3.2	U	31.9	
Mercury, Total	0.41	0.59	* 0.555		0.03	J	0.022	U	0.021	U	0.19	JE
Silver, Total	6.1	6.1	1.2	J	0.42	U	0.42	U	0.41	U	0.77	U
Zinc, Total	410	960	127		41.8		42.2		30.1		138	
Conventionals												
% TOC			0.688		0.239		0.0671		0.0292		1.74	
Acid Volatile Sulfides (mg/Kg)											3300	E
Gravel (%)			9.1		1.6		0.4		2.7		13.4	
Sand (%)			72.9		95.2		94.7		94.9		47.5	
Silt (%)			15.8		3.3		4.9		2.6		18.3	
Clay (%)			2.3		0.3		0.3		0.3		21.2	
Fines (%)			18.1		3.6		5.2		2.9		39.5	
Salinity (ppt)												
% Solids			75.7		90.5		87.9		91.9		51.8	

Table 4-3
SEDIMENT CHEMISTRY RESULTS / SMS COMPARISON

Sample ID / Laboratory ID / Sample Depth (cm) / Sample Date	Marine Sediment Standards		NFK010 L4321-11 0-10 8/17/94		NFK011 L4321-12 0-10 8/22/94		NFK012 L4321-13 0-10 8/18/94		NFK013 L4321-14 0-10 8/19/94		NFK014 L4321-15 0-10 8/19/94	
	SQS	CSL	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.
LPAH (mg/Kg-Organic Carbon)	370	780	1.9		11		30	U	30.6	U	75.4	U
Naphthalene	99	170	2.04	U	7.77	U	30	U	30.6	U	75.4	U
Acenaphthylene	66	66	0.764	U	2.93	U	11	U	11.7	U	27.5	U
Acenaphthene	16	57	0.509	U	2.05	U	7.87	U	7.78	U	* 18.8	U
Fluorene	23	79	0.764	U	2.93	U	11	U	11.7	U	* 27.5	U
Phenanthrene	100	480	1.9		11	G	11	UG	11.7	UG	27.5	UG
Anthracene	220	1200	0.764	UG	2.93	UG	11	UG	11.7	UG	27.5	UG
2-Methylnaphthalene	38	64	2.04	U	7.77	U	30	U	30.6	U	** 75.4	U
HPAH (mg/Kg-Organic Carbon)	960	5300	22.4		122		335		43		65	
Fluoranthene	160	1200	3.36		33	G	48	G	11.7	UG	30	G
Pyrene	1000	1400	3.23		24.2	G	39.2	G	13	G	35	G
Benzo(a)anthracene	110	270	2.13		11.6	G	42.1	G	15	G	27.5	UG
Chrysene	110	460	3.44		16.3	G	49.6		15	J	27.5	U
Total Benzofluoranthenes	230	450	3.93		13		105		30.6	U	75.4	U
Benzo(b)fluoranthene			3.93		13	JG	60.7		30.6	U	75.4	U
Benzo(k)fluoranthene			2.04	UL	7.77	UG	44	J	30.6	U	75.4	U
Benzo(a)pyrene	99	210	2.2	JG	7.8	JG	30	G	19.4	UG	46.4	UG
Indeno(1,2,3-Cd)Pyrene	34	88	2.1	JG	9.7	JG	21	G	19.4	UG	* 46.4	UG
Dibenzo(a,h)anthracene	12	33	2.04	U	7.77	UG	* 30	UG	* 30.6	UG	** 75.4	UG
Benzo(g,h,i)perylene	31	78	2	G	6	JG	19	UG	19.4	UG	* 46.4	UG
Other Nonionizable Organics (mg/Kg-Organic Carbon)												
1,2-Dichlorobenzene	2.3	2.3	0.076	JEG	0.235	U	0.9	UEG	0.944	UEG	** 2.32	UEG
1,4-Dichlorobenzene	3.1	9	0.152	E,G	0.235	U	0.9	UBEG	1.3	BEG	2.5	BEG
1,2,4-Trichlorobenzene	0.81	1.8	0.0618	UEG	0.235	U	* 0.90	UEG	* 0.944	UEG	** 2.32	UEG
Hexachlorobenzene	0.38	2.3	0.0618	UEG	0.235	U	* 0.90	UEG	* 0.944	UEG	** 2.32	UEG
Diethyl Phthalate	61	110	1.27	U	4.99	U	19	U	19.4	U	46.4	U
Dimethyl Phthalate	53	53	0.509	U	2.05	U	7.87	U	7.78	U	18.8	U
Di-N-Butyl Phthalate	220	1700	3.31	G,B	7.6	J,B	64	B	56.3	B	102	B
Benzyl Butyl Phthalate	4.9	64	0.764	U,B	2.93	U	* 45.7		* 17	J	* 27.5	U
Bis(2-Ethylhexyl)Phthalate	47	78	2.21	B	8.48		** 272		* 51.7		** 118	
Di-N-Octyl Phthalate	58	4500	0.764	UL	2.93	U	11	UL	11.7	UL	27.5	UL
Dibenzofuran	15	58	1.27	U	4.99	U	* 19	U	* 19.4	U	* 46.4	U
Hexachlorobutadiene	3.9	6.2	1.27	U	* 4.99	U	** 19	UG	** 19.4	UG	** 46.4	UG
N-Nitrosodiphenylamine	11	11	1.27	U	4.99	U	** 19	U	** 19.4	U	** 46.4	U
Total PCBs	12	65	0.618	U	2.35	U	9	U	9.44	U	* 23.2	U
Ionizable Organics (ug/Kg-Dry Weight)												
Phenol	420	1200	140	U	140	U	140	U	140	U	130	U
2-Methylphenol	63	63	35	U	34	U	33	U	35	U	32	U
4-Methylphenol	670	670	35	U	34	U	33	U	35	U	32	U
2,4-Dimethylphenol	29	29	** 35.0	U	** 34.0	U	** 33	U	** 35.0	U	** 32.0	U
Pentachlorophenol	360	690	35	U	34	UG	33	U	35	U	32	U
Benzyl Alcohol	57	73	35	U	34	U	33	U	35	U	32	U
Benzoic Acid	650	650	140	U	140	U	140	U	140	U	130	U
Metals (mg/Kg-Dry Weight)												
Arsenic, Total	57	93	14	J	6.2	U	9.4	J	11	J	9.7	J
Cadmium, Total	5.1	6.7	0.38	U	0.37	U	0.36	U	0.39	U	0.36	U
Chromium, Total	260	270	14.1		16.1		11.3		13.9		13	
Copper, Total	390	390	14.8		15.4		11.1		12.5		11.3	
Lead, Total	450	530	6.4	J	7.2	J	5.8	J	5.8	J	4.6	J
Mercury, Total	0.41	0.59	0.319	E	0.034	JE	0.025	UE	0.024	UE	0.025	JE
Silver, Total	6.1	6.1	0.51	U	0.5	U	0.48	U	0.51	U	0.47	U
Zinc, Total	410	960	54.2		51.1		41.8		51.4		45.1	
Conventionals												
% TOC			2.75		0.682		0.178		0.18		0.069	
Acid Volatile Sulfides (mg/Kg)			40	UE	50	UE	40	UE	40	UE	40	UE
Gravel (%)			1.6		3.6		0.4		0.2		0.2	
Sand (%)			89.2		87.8		95.4		95.9		100.1	
Silt (%)			8.3		8.9		4		4.6		0.6	
Clay (%)			1.6		0.3		0.3		0.3		0.3	
Fines (%)			9.9		9.2		4.3		4.9		0.9	
Salinity (ppt)			22				5		10			
% Solids			76.8		80.5		80.8		77.7		83.1	

Table 4-3
SEDIMENT CHEMISTRY RESULTS / SMS COMPARISON

Sample ID	Marine Sediment Standards		NFK014 FD		NFK015		NFK016		NFK1992		NFK1992	
Laboratory ID			L4321-16		L4321-17		L4321-18		L6725-35		L6725-36	
Sample Depth (cm)			0-10		0-10		0-10		0-30		30-60	
Sample Date			8/19/94		8/22/94		8/22/94		8/23/95		8/23/95	
	SQS	CSL	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.
LPAH (mg/Kg-Organic Carbon)	370	780	16.6		1.75	U	3.47		4.79		10	
Naphthalene	99	170	17.4	U	1.75	U	5.41	U	5.94	UG	23.3	UG
Acenaphthylene	66	66	6.4	U	0.66	U	1.98	U	2.2	UG	8.57	U
Acenaphthene	16	57	4.57	U	0.464	U	1.35	U	1.49	UG	5.71	U
Fluorene	23	79	6.4	U	0.66	U	1.98	U	2.2	UG	8.57	U
Phenanthrene	100	480	16.6	G	0.66	UG	3.47	G	4.79	G	10	JG
Anthracene	220	1200	6.4	UG	0.66	UG	1.98	UG	2.2	UG	8.57	UG
2-Methylnaphthalene	38	64	17.4	U	1.75	U	5.41	U	5.94	UG	23.3	UG
HPAH (mg/Kg-Organic Carbon)	960	5300	165		1.75	U	7.95		80		23.3	U
Fluoranthene	160	1200	24.5	G	0.662	UG	4.16	G	20.9	G	8.57	UG
Pyrene	1000	1400	24.8	G	0.66	UG	3.79	G	16.3	G	8.57	UG
Benzo(a)anthracene	110	270	15	G	0.66	UG	1.98	UG	7.58	G	8.57	UG
Chrysene	110	460	17		0.66	UG	1.98	UG	9.54	G	8.57	UG
Total Benzofluoranthenes	230	450	21		1.75	U	5.41	U	9.1		23.3	U
Benzo(b)fluoranthene			21		1.75	UG	5.41	UG	9.1	JG	23.3	UG
Benzo(k)fluoranthene			17.4	U	1.75	UG	5.41	UG	5.94	UG	23.3	UG
Benzo(a)pyrene	99	210	11	G	1.09	UG	3.42	UG	5.6	JG	14.8	UG
Indeno(1,2,3-Cd)Pyrene	34	88	19	G	1.09	UG	3.42	UG	5.6	JG	14.8	UG
Dibenzo(a,h)anthracene	12	33	* 17.4	UG	1.75	UG	5.41	UG	5.94	UG	* 23.3	U
Benzo(g,h,i)perylene	31	78	* 32.6	G	1.09	UG	3.42	UG	5.4	JG	14.8	UG
Other Nonionizable Organics (mg/Kg-Organic Carbon)												
1,2-Dichlorobenzene	2.3	2.3	0.518	UEG	0.053	U	0.19	J	0.095	UG	0.371	UG
1,4-Dichlorobenzene	3.1	9	0.55	BEG	0.053	U	0.162	U	0.095	UG	0.43	JG
1,2,4-Trichlorobenzene	0.81	1.8	0.518	UEG	0.053	U	0.162	U	** 2.2	UG	** 8.57	UG
Hexachlorobenzene	0.38	2.3	* 0.518	UEG	0.053	U	0.162	U	0.095	UG	0.371	UG
Diethyl Phthalate	61	110	11	U	1.09	U	3.42	U	3.66	UG	14.8	U
Dimethyl Phthalate	53	53	4.57	U	0.464	U	1.35	U	1.49	UG	5.71	U
Di-N-Butyl Phthalate	220	1700	33.8	B	2.2	J,B	6.6	J,B	71.6	BG	20	J,B
Benzyl Butyl Phthalate	4.9	64	* 11.4		0.66	U	1.98	U	2.2	UG	* 8.57	U
Bis(2-Ethylhexyl)Phthalate	47	78	34.1		0.89	J	4.37		11.2	G	16.3	
Di-N-Octyl Phthalate	58	4500	6.4	UL	0.66	U	1.98	U	2.2	UG	8.57	U
Dibenzofuran	15	58	11	U	1.09	U	3.42	U	3.66	UG	14.8	U
Hexachlorobutadiene	3.9	6.2	** 11.0	UG	1.09	U	3.42	U	3.66	UG	** 14.8	UG
N-Nitrosodiphenylamine	11	11	11	U	1.09	U	3.7	J	3.66	U,B,G	** 14.8	U,B
Total PCBs	12	65	5.18	U	0.53	U	1.62	U	1.8	U	7.14	U
Ionizable Organics (ug/Kg-Dry Weight)												
Phenol	420	1200	150	U	140	U	150	U	150	U	120	U
2-Methylphenol	63	63	36	U	33	U	38	U	37	U	31	U
4-Methylphenol	670	670	36	U	33	U	38	U	37	U	31	U
2,4-Dimethylphenol	29	29	** 36.0	U	** 33.0	U	** 38.0	U	** 37.0	UG	** 31.0	UG
Pentachlorophenol	360	690	36	U	33	UG	38	UG	37	U	31	U
Benzyl Alcohol	57	73	36	U	33	U	38	U	37	UG	31	UG
Benzoic Acid	650	650	150	U	140	U	150	U	180	JE	323	E
Metals (mg/Kg-Dry Weight)												
Arsenic, Total	57	93	12	J	6.2	U	7	U	7.9	J	5.6	U
Cadmium, Total	5.1	6.7	0.4	U	0.37	U	0.42	U	0.39	U	0.33	U
Chromium, Total	260	270	14.3		10.9		16.1		18.3		11.3	
Copper, Total	390	390	14.4		13.6		22.2		20.5		13.7	
Lead, Total	450	530	7.7	J	6.4	J	7.4	J	7.1	J	4	J
Mercury, Total	0.41	0.59	0.026	UE	0.025	UE	0.039	JE	0.069	J	0.022	J
Silver, Total	6.1	6.1	0.53	U	0.49	U	0.56	U	0.51	U	0.53	J
Zinc, Total	410	960	52.7		48.1		56.8		60.7		46.5	
Conventionals												
% TOC			0.326		3.02		1.11		1.01		0.21	
Acid Volatile Sulfides (mg/Kg)			50	UE	50	UE	60	UE				
Gravel (%)			0.2		0.8		1.8		0.7		5.1	
Sand (%)			95.3		99.2		95		79.4		91.6	
Silt (%)			4.2		0.4		3.3		19.2		3.4	
Clay (%)			0.4		0.3		0.3		1.1		0.3	
Fines (%)			4.6		0.7		3.6		20.3		3.7	
Salinity (ppt)												
% Solids			75.7		81		71.5		72.1		88.2	

Table 4-3
SEDIMENT CHEMISTRY RESULTS / SMS COMPARISON

Sample ID	Marine Sediment Standards		NFK1992		NFK1992		NFK1992 FD		NFK1992 FD		NFK201	
Laboratory ID			L6725-37		L6725-38		L6725-44		L6725-45		L6725-1	
Sample Depth (cm)			60-90		90-120		0-30		30-60		0-10	
Sample Date			8/23/95		8/23/95		8/23/95		8/23/95		8/23/95	
	SQS	CSL	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.
LPAH (mg/Kg-Organic Carbon)	370	780	4.33	U	69.3	U	6.11		59.1	U	33.9	
Naphthalene	99	170	4.33	UG	69.3	UG	7.4	UG	59.1	UG	3.56	UG
Acenaphthylene	66	66	1.64	UG	26.5	U	2.75	UG	21.4	UG	1.3	UG
Acenaphthene	16	57	1.12	UG	* 17.7	U	1.88	UG	15.1	UG	2.2	G
Fluorene	23	79	1.64	UG	* 26.5	U	2.75	UG	21.4	UG	2.6	G
Phenanthrene	100	480	1.64	UG	26.5	UG	6.11	G	21.4	UG	24.3	G
Anthracene	220	1200	1.64	UG	26.5	UG	2.75	UG	21.4	UG	4.82	G
2-Methylnaphthalene	38	64	4.33	UG	** 69.3	UG	7.4	UG	* 59.1	UG	3.56	UG
HPAH (mg/Kg-Organic Carbon)	960	5300	4.33	U	69.3	U	69.4		59.1	U	133	
Fluoranthene	160	1200	1.64	UG	26.5	UG	19.3	G	21.4	UG	30	G
Pyrene	1000	1400	1.64	UG	26.5	UG	15.4	G	21.4	UG	25.7	G
Benzo(a)anthracene	110	270	1.64	UG	26.5	UG	8	G	21.4	UG	12.1	G
Chrysene	110	460	1.64	UG	26.5	UG	8.65	G	21.4	UG	14.1	G
Total Benzofluoranthenes	230	450	4.33	U	69.3	U	11		59.1	U	18	
Benzo(b)fluoranthene			4.33	UG	69.3	UG	11	JG	59.1	UG	12.6	G
Benzo(k)fluoranthene			4.33	UG	69.3	UG	7.4	UG	59.1	UG	5.4	JG
Benzo(a)pyrene	99	210	2.76	UG	44.2	UG	7	JG	36.5	UG	11.2	G
Indeno(1,2,3-Cd)Pyrene	34	88	2.76	UG	* 44.2	UG	4.63	UG	* 36.5	UG	12	G
Dibenzo(a,h)anthracene	12	33	4.33	UG	** 69.3	U	7.4	UG	** 59.1	UG	3.56	UG
Benzo(g,h,i)perylene	31	78	2.76	UG	* 44.2	UG	4.63	UG	* 36.5	UG	9.9	G
Other Nonionizable Organics (mg/Kg-Organic Carbon)												
1,2-Dichlorobenzene	2.3	2.3	0.0701	UG	1.12	UG	0.119	UG	0.943	UG	0.0586	UG
1,4-Dichlorobenzene	3.1	9	0.0701	UG	1.12	UG	0.14	JG	0.943	UG	0.0586	UG
1,2,4-Trichlorobenzene	0.81	1.8	* 1.64	UG	** 26.5	UG	** 2.75	UG	** 21.4	UG	* 1.3	UG
Hexachlorobenzene	0.38	2.3	0.0701	UG	* 1.12	UG	0.119	UG	* 0.943	UG	0.0586	UG
Diethyl Phthalate	61	110	2.76	UG	44.2	U	4.63	UG	36.5	UG	2.25	UG
Dimethyl Phthalate	53	53	1.12	UG	17.7	U	1.9	UG	15.1	UG	0.901	UG
Di-N-Butyl Phthalate	220	1700	5.87	BG	46	J,B	15.3	BG	49	J,B,G	4.1	J,B,G
Benzyl Butyl Phthalate	4.9	64	1.64	UG	* 26.5	U	2.75	UG	* 21.4	UG	1.4	JG
Bis(2-Ethylhexyl)Phthalate	47	78	1.64	UG	32	J	16.9	G	30	JG	15.2	G
Di-N-Octyl Phthalate	58	4500	1.64	UG	26.5	U	2.75	UG	21.4	UG	1.3	UG
Dibenzofuran	15	58	2.76	UG	* 44.2	U	4.63	UG	* 36.5	UG	2.25	UG
Hexachlorobutadiene	3.9	6.2	2.76	UG	** 44.2	UG	* 4.63	UG	** 36.5	UG	2.25	UG
N-Nitrosodiphenylamine	11	11	2.76	U,B,G	** 44.2	U,B	4.63	U,B,G	** 36.5	U,B,G	2.25	U,B,G
Total PCBs	12	65	1.34	U	* 20.6	U	2.25	U	* 17.6	U	** 135	
Ionizable Organics (ug/Kg-Dry Weight)												
Phenol	420	1200	150	U	120	U	150	U	120	UG	200	U
2-Methylphenol	63	63	37	U	30	U	37	U	29	UG	50	U
4-Methylphenol	670	670	37	U	30	U	37	U	29	UG	50	U
2,4-Dimethylphenol	29	29	** 37.0	UG	** 30.0	UG	** 37.0	UG	29	UG	** 50.0	UG
Pentachlorophenol	360	690	37	U	30	U	37	U	29	UG	50	U
Benzyl Alcohol	57	73	37	UG	30	UG	37	UG	29	UG	50	UG
Benzoic Acid	650	650	150	UE	120	UE	180	JE	120	UEG	200	UE
Metals (mg/Kg-Dry Weight)												
Arsenic, Total	57	93	6.7	U	4.9	U	6.9	J	5.5	U	8.1	U
Cadmium, Total	5.1	6.7	0.39	U	0.3	U	0.38	U	0.33	U	0.51	J
Chromium, Total	260	270	13		11.8		17.3		11.2		24.2	
Copper, Total	390	390	18.1		11.1		20.6		11.7		37.6	
Lead, Total	450	530	3.9	U	3	U	8	J	3.9	J	37.8	
Mercury, Total	0.41	0.59	0.027	U	0.023	U	0.043	J	0.022	U	0.1	J
Silver, Total	6.1	6.1	0.53	U	0.44	J	0.59	J	0.44	J	0.97	J
Zinc, Total	410	960	37.1		27.4		62.8		43.7		103	
Conventionals												
% TOC			1.34		0.0678		0.799		0.0795		2.22	
Acid Volatile Sulfides (mg/Kg)												
Gravel (%)			9.4		2		1		2.8		0.2	
Sand (%)			86		95.2		91.1		95.5		49.6	
Silt (%)			4.5		2.8		7.6		1.8		46.9	
Clay (%)			0.3		0.3		0.5		0.3		3.8	
Fines (%)			4.8		3.1		8.1		2.1		50.7	
Salinity (ppt)												
% Solids			73.6		91		72.8		91.6		54.5	

Table 4-3
SEDIMENT CHEMISTRY RESULTS / SMS COMPARISON

Sample ID / Laboratory ID / Sample Depth (cm) / Sample Date	Marine Sediment Standards		NFK201 L7462-16 0-10 12/5/95		NFK201 FD L7462-17 0-10 12/5/95		NFK202 L6725-2 0-10 8/23/95		NFK203 L6725-3 0-10 8/23/95		NFK204 L6725-4 0-10 8/23/95	
	SQS	CSL	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.
LPAH (mg/Kg-Organic Carbon)	370	780	4.2	U	8.4		7.4		58.1		28.8	
Naphthalene	99	170	4.2	U	7.7	U	4.42	UG	6.41	UG	7.74	UG
Acenaphthylene	66	66	4.2	U	7.7	U	1.66	UG	2.43	U	2.91	U
Acenaphthene	16	57	4.2	U	7.7	U	1.1	UG	2.1	J	2.02	U
Fluorene	23	79	4.2	U	7.7	U	1.66	UG	2.8	J	2.91	U
Phenanthrene	100	480	4.2	U	8.4		7.4	G	45.1	G	24.9	G
Anthracene	220	1200	4.2	U	7.7	U	1.66	UG	8.11	G	3.9	JG
2-Methylnaphthalene	38	64	4.2	U	7.7	U	4.42	UG	6.41	UG	7.74	UG
HPAH (mg/Kg-Organic Carbon)	960	5300	5.1		45		78.6		421		242	
Fluoranthene	160	1200	5.1		21		17.4	G	91	G	52.1	G
Pyrene	1000	1400	4.2	U	15		11.3	G	75.9	G	45	G
Benzo(a)anthracene	110	270	4.2	U	7.7	U	6.2	G	36.7	G	20.3	G
Chrysene	110	460	4.2	U	9		8.22	G	42.1	G	33.3	G
Total Benzofluoranthenes	230	450	4.2	U	7.7	U	14.3		67.6		40.9	
Benzo(b)fluoranthene			4.2	U	7.7	U	9.57	G	43.5	G	28.9	G
Benzo(k)fluoranthene			4.2	U	7.7	U	4.7	JG	24.1	G	12	JG
Benzo(a)pyrene	99	210	4.2	U	7.7	U	6.38	G	34.7	G	18.4	G
Indeno(1,2,3-Cd)Pyrene	34	88	4.2	U	7.7	U	7.85	G	32.7	G	16.1	G
Dibenzo(a,h)anthracene	12	33	4.2	U	7.7	U	4.42	UG	6.6	J	7.74	U
Benzo(g,h,i)perylene	31	78	4.2	U	7.7	U	6.99	G	33.5	G	16	G
Other Nonionizable Organics (mg/Kg-Organic Carbon)												
1,2-Dichlorobenzene	2.3	2.3	** 4.2	U	** 7.7	U	0.0736	UG	0.107	UG	0.123	UG
1,4-Dichlorobenzene	3.1	9	* 4.2	U	* 7.7	U	0.29	G	** 13.7	G	0.383	G
1,2,4-Trichlorobenzene	0.81	1.8	** 4.2	U	** 7.7	U	* 1.66	UG	** 2.43	UG	** 2.91	UG
Hexachlorobenzene	0.38	2.3	** 4.2	U	** 7.7	U	0.0736	UG	0.107	U	0.123	U
Diethyl Phthalate	61	110	4.2	U	7.7	U	2.8	UG	4.1	U	4.82	U
Dimethyl Phthalate	53	53	4.2	U	7.7	U	1.1	UG	1.65	U	2.02	U
Di-N-Butyl Phthalate	220	1700	4.2	U	7.7	U	4.8	J,B,G	19.2	B	16.1	B
Benzyl Butyl Phthalate	4.9	64	4.2	U	* 7.7	U	1.66	UG	* 11.1		2.91	U
Bis(2-Ethylhexyl)Phthalate	47	78	4.2	U	12		18.7	G	** 88.4		23	
Di-N-Octyl Phthalate	58	4500	4.2	U	7.7	U	1.66	UG	2.43	U	2.91	U
Dibenzofuran	15	58	4.2	U	7.7	U	2.8	UG	4.1	U	4.82	U
Hexachlorobutadiene	3.9	6.2	** 8.4	U	** 15	U	2.8	UG	* 4.1	UG	* 4.82	UG
N-Nitrosodiphenylamine	11	11	4.2	U	7.7	U	2.8	U,B,G	4.1	U,B	4.82	U,B
Total PCBs	12	65	26.0		32.0		12.1		3		2.35	U
Ionizable Organics (ug/Kg-Dry Weight)												
Phenol	420	1200	280	U	240	U	180	UG	170	U	180	U
2-Methylphenol	63	63	** 280	U	** 240	U	45	UG	42	U	43	U
4-Methylphenol	670	670	140	U	120	U	45	UG	42	U	43	U
2,4-Dimethylphenol	29	29	** 420	U	** 370	U	** 45	UG	** 42	UG	** 43.0	UG
Pentachlorophenol	360	690	** 700	U	* 610	U	45	UG	42	U	43	U
Benzyl Alcohol	57	73	** 700	U	** 610	U	45	UG	42	UG	43	UG
Benzoic Acid	650	650	** 1400	U	** 1200	U	** 1500	E,G	252	E	323	E
Metals (mg/Kg-Dry Weight)												
Arsenic, Total	57	93					9.8	J	7.2	J	14	J
Cadmium, Total	5.1	6.7					0.47	U	0.55	J	0.43	U
Chromium, Total	260	270					28.7		24		21.3	
Copper, Total	390	390					36.6		48.6		30.7	
Lead, Total	450	530					32.6		62.2		24.1	
Mercury, Total	0.41	0.59					0.23	J	** 3.72		0.085	J
Silver, Total	6.1	6.1					0.87	J	0.91	J	0.58	U
Zinc, Total	410	960					106		175		89.9	
Conventionals												
% TOC			3.33		1.55		1.63		1.03		0.892	
Acid Volatile Sulfides (mg/Kg)												
Gravel (%)			0.2		0.3		0.4		0.2		2.3	
Sand (%)			41.1		55.8		35.1		71.6		66.8	
Silt (%)			52.5		37.4		60.2		26.7		28.6	
Clay (%)			6.6		6.7		4.5		1.3		2.3	
Fines (%)			59.1		44.1		64.7		28		30.9	
Salinity (ppt)												
% Solids			49.5		55.3		59.9		65		62.3	

Table 4-3
SEDIMENT CHEMISTRY RESULTS / SMS COMPARISON

Sample ID / Laboratory ID / Sample Depth (cm) / Sample Date	Marine Sediment Standards		NFK207 / L6725-8 / 0-30 / 8/28/95		NFK207 / L6725-9 / 30-60 / 8/28/95		NFK301 / L7462-1 / 0-10 / 12/6/95		NFK302 / L7462-2 / 0-10 / 12/6/95		NFK303 / L7462-3 / 0-10 / 12/6/95	
	SQS	CSL	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.
LPAH (mg/Kg-Organic Carbon)	370	780	261		110		5.4	U	230	U	17	
Naphthalene	99	170	18.2	UG	30.4	UG	5.4	U	** 230	U	5.8	U
Acenaphthylene	66	66	9.4	J	11.4	UG	5.4	U	** 230	U	5.8	U
Acenaphthene	16	57	* 16.7		* 18.5	G	5.4	U	** 230	U	5.8	U
Fluorene	23	79	16.2		11.4	UG	5.4	U	** 230	U	5.8	U
Phenanthrene	100	480	* 182	G	73.4	G	5.4	U	* 230	U	17	
Anthracene	220	1200	36.7	G	18	JG	5.4	U	* 230	U	5.8	U
2-Methylnaphthalene	38	64	18.2	UG	30.4	UG	5.4	U	** 230	U	5.8	U
HPAH (mg/Kg-Organic Carbon)	960	5300	* 3150		823		13		230	U	130	
Fluoranthene	160	1200	* 598	G	* 172	G	7.1		* 230	U	35	
Pyrene	1000	1400	556	G	148	G	5.8		230	U	24	
Benzo(a)anthracene	110	270	** 300	G	61.6	G	5.4	U	* 230	U	9.8	
Chrysene	110	460	313	G	70.9	G	5.4	U	* 230	U	15	
Total Benzofluoranthenes	230	450	** 545		110		5.4	U	230	U	23	
Benzo(b)fluoranthene			402	G	76	G	5.4	U	230	U	12	
Benzo(k)fluoranthene			143	G	36	JG	5.4	U	230	U	11	
Benzo(a)pyrene	99	210	387	G	73.4	G	5.4	U	** 230	U	11	
Indeno(1,2,3-Cd)Pyrene	34	88	221	G	** 96.8	G	5.4	U	** 230	U	6.7	
Dibenzo(a,h)anthracene	12	33	44.1		* 30.4	UG	5.4	U	** 230	U	5.8	U
Benzo(g,h,i)perylene	31	78	** 207	G	** 90.5	G	5.4	U	** 230	U	8	
Other Nonionizable Organics (mg/Kg-Organic Carbon)												
1,2-Dichlorobenzene	2.3	2.3	0.608	G	0.49	UG	** 5.4	U	** 230	U	** 5.8	U
1,4-Dichlorobenzene	3.1	9	** 283	G	** 10.6	G	* 5.4	U	** 230	U	* 5.8	U
1,2,4-Trichlorobenzene	0.81	1.8	** 6.64	UG	** 11.4	UG	** 5.4	U	** 230	U	** 5.8	U
Hexachlorobenzene	0.38	2.3	0.29	U	* 0.49	UG	** 5.4	U	** 230	U	** 5.8	U
Diethyl Phthalate	61	110	11.5	U	20	UG	5.4	U	** 230	U	5.8	U
Dimethyl Phthalate	53	53	4.55	U	7.6	UG	5.4	U	** 230	U	5.8	U
Di-N-Butyl Phthalate	220	1700	41.6	B	28	J,B,G	5.4	U	* 230	U	5.8	U
Benzyl Butyl Phthalate	4.9	64	* 44.4		* 11.4	UG	* 5.4	U	** 230	U	* 5.8	U
Bis(2-Ethylhexyl)Phthalate	47	78	** 503		** 83.5	G	9.2		** 230	U	8	
Di-N-Octyl Phthalate	58	4500	6.64	U	11.4	UG	5.4	U	* 230	U	5.8	U
Dibenzofuran	15	58	11.5	U	* 20	UG	5.4	U	** 230	U	5.8	U
Hexachlorobutadiene	3.9	6.2	** 11.5	UG	** 20	UG	** 10	U	** 440	U	** 12	U
N-Nitrosodiphenylamine	11	11	** 12	J,B	** 20	U,B,G	5.4	U	** 230	U	5.8	U
Total PCBs	12	65	** 28.0		9.49	U	2.15		* 50		11.1	
Ionizable Organics (ug/Kg-Dry Weight)												
Phenol	420	1200	130	U	120	U	250	U	140	U	260	U
2-Methylphenol	63	63	33	U	30	U	** 250	U	** 140	U	** 260	U
4-Methylphenol	670	670	33	U	30	U	130	U	72	U	130	U
2,4-Dimethylphenol	29	29	** 33.0	UG	** 30	UG	** 380	U	** 220	U	** 390	U
Pentachlorophenol	360	690	33	U	30	U	* 630	U	360	U	* 640	U
Benzyl Alcohol	57	73	33	UG	30	UG	** 630	U	** 360	U	** 640	U
Benzoic Acid	650	650	130	UE	140	JE	** 1300	U	** 720	U	** 1300	U
Metals (mg/Kg-Dry Weight)												
Arsenic, Total	57	93	6.2	U	5	U						
Cadmium, Total	5.1	6.7	0.82	J	0.53	J						
Chromium, Total	260	270	27.7		17.9							
Copper, Total	390	390	123		118							
Lead, Total	450	530	103		36.7							
Mercury, Total	0.41	0.59	0.367		0.14	J						
Silver, Total	6.1	6.1	1.4	J	0.61	J						
Zinc, Total	410	960	263		133							
Conventionals												
% TOC			0.286		0.158		2.4		0.0317		2.25	
Acid Volatile Sulfides (mg/Kg)												
Gravel (%)			18.6		13.6		0.5		0.9		1	
Sand (%)			72.1		84.6		44.9		97.6		42.7	
Silt (%)			8.5		1.8		46.5		1.4		49.7	
Clay (%)			0.9		0.3		8.2		0.3		6.6	
Fines (%)			9.4		2.1		54.7		1.7		56.3	
Salinity (ppt)												
% Solids			82.8		88.8		50.1		93.8		49.8	

Table 4-3
SEDIMENT CHEMISTRY RESULTS / SMS COMPARISON

Sample ID	Marine Sediment Standards		NFK205		NFK206		NFK206 FD		NFK207		NFK207	
Laboratory ID			L6725-5		L6725-6		L6725-7		L6725-10		L6725-11	
Sample Depth (cm)			0-10		0-10		0-10		60-90		90-120	
Sample Date			8/28/95		8/28/95		8/28/95		8/28/95		8/28/95	
	SQS	CSL	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.
LPAH (mg/Kg-Organic Carbon)	370	780	12.9		5.17	U	12.9	U	60	U	179	U
Naphthalene	99	170	4.01	UG	5.17	UG	12.9	UG	60	UG	** 179	UG
Acenaphthylene	66	66	1.5	UG	1.9	U	4.76	UG	21.9	UG	** 66.2	U
Acenaphthene	16	57	1.01	UG	1.37	U	3.33	UG	15.3	UG	* 46.4	U
Fluorene	23	79	1.5	UG	1.9	U	4.76	UG	21.9	UG	* 66.2	U
Phenanthrene	100	480	10.9	G	1.9	UG	4.76	UG	21.9	UG	66.2	UG
Anthracene	220	1200	2	JG	1.9	UG	4.76	UG	21.9	UG	66.2	UG
2-Methylnaphthalene	38	64	4.01	UG	5.17	UG	12.9	UG	* 60	UG	** 179	UG
HPAH (mg/Kg-Organic Carbon)	960	5300	116		2.4		5.5		60	U	179	U
Fluoranthene	160	1200	25.3	G	2.4	JG	5.5	JG	20	UG	70	UG
Pyrene	1000	1400	16	G	1.9	UG	4.76	UG	21.9	UG	66.2	UG
Benzo(a)anthracene	110	270	8.02	G	1.9	UG	4.76	UG	21.9	UG	66.2	UG
Chrysene	110	460	11.3	G	1.9	UG	4.76	UG	21.9	UG	66.2	UG
Total Benzofluoranthenes	230	450	22		5.17	U	12.9	U	60	U	179	U
Benzo(b)fluoranthene			15.2	G	5.17	UG	12.9	UG	60	UG	179	UG
Benzo(k)fluoranthene			6.8	JG	5.17	UG	12.9	UG	60	UG	179	UG
Benzo(a)pyrene	99	210	9.81	G	3.27	UG	8.1	UG	37.2	UG	* 113	UG
Indeno(1,2,3-Cd)Pyrene	34	88	11.5	G	3.27	UG	8.1	UG	* 37.2	UG	** 113	UG
Dibenzo(a,h)anthracene	12	33	4.01	UG	5.17	U	* 12.9	UG	** 60	UG	** 179	U
Benzo(g,h,i)perylene	31	78	12.5	G	3.27	UG	8.1	UG	* 37.2	UG	** 113	UG
Other Nonionizable Organics (mg/Kg-Organic Carbon)												
1,2-Dichlorobenzene	2.3	2.3	0.0628	U,G,X	0.0833	UG	0.207	UG	0.941	UG	** 2.85	UG
1,4-Dichlorobenzene	3.1	9	0.169	GX	0.0833	UG	0.207	UG	2.25	G	2.85	UG
1,2,4-Trichlorobenzene	0.81	1.8	* 1.50	UG	** 1.90	UG	** 4.76	UG	** 21.9	UG	** 66.2	UG
Hexachlorobenzene	0.38	2.3	0.0628	UX	0.0833	UG	0.207	UG	* 0.941	UG	** 2.85	U
Diethyl Phthalate	61	110	2.51	UG	3.27	U	8.1	UG	37.2	UG	** 113	U
Dimethyl Phthalate	53	53	1.01	UG	1.37	U	3.33	UG	20	UG	50	U
Di-N-Butyl Phthalate	220	1700	9.9	BG	5.5	J,B	12	J,B,G	81.5	BG	* 310	B
Benzyl Butyl Phthalate	4.9	64	1.5	UG	1.9	U	4.76	UG	* 21.9	UG	** 66.2	U
Bis(2-Ethylhexyl)Phthalate	47	78	18.7	G	4.86		4.76	UG	20	JG	** 79	J
Di-N-Octyl Phthalate	58	4500	1.5	UG	1.9	U	4.76	UG	21.9	UG	* 66.2	U
Dibenzofuran	15	58	2.51	UG	3.27	U	8.1	UG	* 37.2	UG	** 113	U
Hexachlorobutadiene	3.9	6.2	2.51	UG	3.27	UG	** 8.10	UG	** 37.2	UG	** 113	UG
N-Nitrosodiphenylamine	11	11	2.51	U,B,G	3.27	U,B	8.1	U,B,G	** 37.2	U,B,G	** 113	U,B
Total PCBs	12	65	* 61.8		1.58	U	3.81	U	* 17.5	U	* 53.0	U
Ionizable Organics (ug/Kg-Dry Weight)												
Phenol	420	1200	210	UG	130	U	140	U	100	UG	100	U
2-Methylphenol	63	63	52	UG	31	U	34	U	34	UG	34	U
4-Methylphenol	670	670	52	UG	31	U	34	U	34	UG	34	U
2,4-Dimethylphenol	29	29	** 52.0	UG	** 31.0	UG	** 34.0	UG	** 34.0	UG	** 34.0	UG
Pentachlorophenol	360	690	52	UG	31	U	34	U	34	UG	34	U
Benzyl Alcohol	57	73	52	UG	31	UG	34	UG	34	UG	34	UG
Benzoic Acid	650	650	310	JEG	130	UE	140	UE	100	UEG	100	UE
Metals (mg/Kg-Dry Weight)												
Arsenic, Total	57	93	9.1	U	8	J	6.4	J	6.1	U	6	U
Cadmium, Total	5.1	6.7	0.54	U	0.32	U	0.33	U	0.38	U	0.36	U
Chromium, Total	260	270	22		22		12.6		14.5		15.7	
Copper, Total	390	390	28.8		26.3		13.7		9.2		9.04	
Lead, Total	450	530	18	J	6.2	J	3.3	U	10	J	3.6	U
Mercury, Total	0.41	0.59	0.33	J	0.028	J	0.026	U	0.025	U	0.025	U
Silver, Total	6.1	6.1	0.89	J	0.44	U	0.44	U	0.49	U	0.61	J
Zinc, Total	410	960	81.3		52.9		50.8		26.5		25.6	
Conventionals												
% TOC			2.07		0.946		0.42		0.0914		0.0302	
Acid Volatile Sulfides (mg/Kg)												
Gravel (%)			0.3		1.2		7		0.2		0.7	
Sand (%)			51.8		86.5		91		91.4		92.9	
Silt (%)			43.9		12.2		2		8.5		6.4	
Clay (%)			4.4		0.3		0.4		0.3		0.3	
Fines (%)			48.3		12.5		2.4		8.8		6.7	
Salinity (ppt)												
% Solids			51.8		87.2		79.3		80		80.1	

Table 4-3
SEDIMENT CHEMISTRY RESULTS / SMS COMPARISON

Sample ID	Marine Sediment Standards		NFK304		NFK305		NFK306		NFK307		NFK308	
Laboratory ID			L7462-4		L7462-5		L7462-6		L7462-7		L7462-8	
Sample Depth (cm)			0-10		0-10		0-10		0-10		0-10	
Sample Date			12/6/95		12/6/95		12/6/95		12/6/95		12/6/95	
	SQS	CSL	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.
LPAH (mg/Kg-Organic Carbon)	370	780	6.1	U	5.6	U	4.5	U	13		7.9	
Naphthalene	99	170	6.1	U	5.6	U	4.5	U	12	U	4.1	U
Acenaphthylene	66	66	6.1	U	5.6	U	4.5	U	12	U	4.1	U
Acenaphthene	16	57	6.1	U	5.6	U	4.5	U	12	U	4.1	U
Fluorene	23	79	6.1	U	5.6	U	4.5	U	12	U	4.1	U
Phenanthrene	100	480	6.1	U	5.6	U	4.5	U	13		7.9	
Anthracene	220	1200	6.1	U	5.6	U	4.5	U	12	U	4.1	U
2-Methylnaphthalene	38	64	6.1	U	5.6	U	4.5	U	12	U	4.1	U
HPAH (mg/Kg-Organic Carbon)	960	5300	6.1	U	30		12		63		27	
Fluoranthene	160	1200	6.1	U	12		5.4		27		11	
Pyrene	1000	1400	6.1	U	12		6.1		21		10	
Benzo(a)anthracene	110	270	6.1	U	5.6	U	4.5	U	12	U	4.1	U
Chrysene	110	460	6.1	U	6		4.5	U	15		5.5	
Total Benzofluoranthenes	230	450	6.1	U	5.6	U	4.5	U	12	U	4.1	U
Benzo(b)fluoranthene			6.1	U	5.6	U	4.5	U	12	U	4.1	U
Benzo(k)fluoranthene			6.1	U	5.6	U	4.5	U	12	U	4.1	U
Benzo(a)pyrene	99	210	6.1	U	5.6	U	4.5	U	12	U	4.1	U
Indeno(1,2,3-Cd)Pyrene	34	88	6.1	U	5.6	U	4.5	U	12	U	4.1	U
Dibenzo(a,h)anthracene	12	33	6.1	U	5.6	U	4.5	U	12	U	4.1	U
Benzo(g,h,i)perylene	31	78	6.1	U	5.6	U	4.5	U	12	U	4.1	U
Other Nonionizable Organics (mg/Kg-Organic Carbon)												
1,2-Dichlorobenzene	2.3	2.3	** 6.1	U	** 5.6	U	** 4.5	U	** 12	U	** 4.1	U
1,4-Dichlorobenzene	3.1	9	* 6.1	U	* 5.6	U	* 4.5	U	** 12	U	* 4.1	U
1,2,4-Trichlorobenzene	0.81	1.8	** 6.1	U	** 5.6	U	** 4.5	U	** 12	U	** 4.1	U
Hexachlorobenzene	0.38	2.3	** 6.1	U	** 5.6	U	** 4.5	U	** 12	U	** 4.1	U
Diethyl Phthalate	61	110	6.1	U	5.6	U	4.5	U	12	U	4.1	U
Dimethyl Phthalate	53	53	6.1	U	5.6	U	4.5	U	12	U	4.1	U
Di-N-Butyl Phthalate	220	1700	6.1	U	5.6	U	4.5	U	12	U	4.1	U
Benzyl Butyl Phthalate	4.9	64	* 6.1	U	* 5.6	U	4.5	U	* 12	U	4.1	U
Bis(2-Ethylhexyl)Phthalate	47	78	13		22		7.4		26		4.1	U
Di-N-Octyl Phthalate	58	4500	6.1	U	5.6	U	4.5	U	12	U	4.1	U
Dibenzofuran	15	58	6.1	U	5.6	U	4.5	U	12	U	4.1	U
Hexachlorobutadiene	3.9	6.2	** 12	U	** 11	U	** 8.7	U	** 25	U	** 8.6	U
N-Nitrosodiphenylamine	11	11	6.1	U	5.6	U	4.5	U	** 12	U	4.1	U
Total PCBs	12	65	** 18.6		** 10400		** 43.6		* 49.8		* 29.3	
Ionizable Organics (ug/Kg-Dry Weight)												
Phenol	420	1200	240	U	240	U	270	U	220	U	250	U
2-Methylphenol	63	63	** 240	U	** 240	U	** 270	U	** 220	U	** 250	U
4-Methylphenol	670	670	120	U	120	U	140	U	110	U	120	U
2,4-Dimethylphenol	29	29	** 360	U	** 370	U	** 410	U	** 320	U	** 370	U
Pentachlorophenol	360	690	* 590	U	* 610	U	* 680	U	* 540	U	* 620	U
Benzyl Alcohol	57	73	** 590	U	** 610	U	** 680	U	** 540	U	** 620	U
Benzoic Acid	650	650	** 1200	U	** 4500		** 1400	U	** 1100	U	** 1200	U
Metals (mg/Kg-Dry Weight)												
Arsenic, Total	57	93										
Cadmium, Total	5.1	6.7										
Chromium, Total	260	270										
Copper, Total	390	390										
Lead, Total	450	530										
Mercury, Total	0.41	0.59										
Silver, Total	6.1	6.1										
Zinc, Total	410	960										
Conventionals												
% TOC			1.96		2.15		3.12		0.896		2.9	
Acid Volatile Sulfides (mg/Kg)												
Gravel (%)			0.4		3.5		0.4		0.2		0.2	
Sand (%)			36.2		49.5		35.5		82.1		39.9	
Silt (%)			55.6		41.7		57.1		15		52.3	
Clay (%)			8		5.5		7		2.9		8	
Fines (%)			63.6		47.2		64.1		17.9		60.3	
Salinity (ppt)												
% Solids			53.5		52.1		48.1		60.7		52.8	

Table 4-3
SEDIMENT CHEMISTRY RESULTS / SMS COMPARISON

Sample ID / Laboratory ID / Sample Depth (cm) / Sample Date	Marine Sediment Standards		NFK308 FD L7462-18 0-10 12/6/95		NFK309 L7462-9 0-10 12/5/95		NFK310 L7462-10 0-10 12/5/95		NFK311 L7462-11 0-10 12/5/95		NFK312 L7462-12 0-10 12/5/95	
	SQS	CSL	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.
LPAH (mg/Kg-Organic Carbon)	370	780			5.9	U	6.2	U	10		11	
Naphthalene	99	170			5.9	U	6.2	U	8.5	U	6.6	U
Acenaphthylene	66	66			5.9	U	6.2	U	8.5	U	6.6	U
Acenaphthene	16	57			5.9	U	6.2	U	8.5	U	6.6	U
Fluorene	23	79			5.9	U	6.2	U	8.5	U	6.6	U
Phenanthrene	100	480			5.9	U	6.2	U	10		11	
Anthracene	220	1200			5.9	U	6.2	U	8.5	U	6.6	U
2-Methylnaphthalene	38	64			5.9	U	6.2	U	8.5	U	6.6	U
HPAH (mg/Kg-Organic Carbon)	960	5300			6.4		6.2	U	97		86	
Fluoranthene	160	1200			6.4		6.2	U	25		23	
Pyrene	1000	1400			5.9	U	6.2	U	20		19	
Benzo(a)anthracene	110	270			5.9	U	6.2	U	8.5		7.1	
Chrysene	110	460			5.9	U	6.2	U	14		12	
Total Benzofluoranthenes	230	450			5.9	U	6.2	U	20		17	
Benzo(b)fluoranthene					5.9	U	6.2	U	9.8		8.1	
Benzo(k)fluoranthene					5.9	U	6.2	U	9.8		9.1	
Benzo(a)pyrene	99	210			5.9	U	6.2	U	9.8		8.1	
Indeno(1,2,3-Cd)Pyrene	34	88			5.9	U	6.2	U	8.5	U	6.6	U
Dibenzo(a,h)anthracene	12	33			5.9	U	6.2	U	8.5	U	6.6	U
Benzo(g,h,i)perylene	31	78			5.9	U	6.2	U	8.5	U	6.6	U
Other Nonionizable Organics (mg/Kg-Organic Carbon)												
1,2-Dichlorobenzene	2.3	2.3			** 5.9	U	** 6.2	U	** 8.5	U	** 6.6	U
1,4-Dichlorobenzene	3.1	9			* 5.9	U	* 6.2	U	* 8.5	U	* 6.6	U
1,2,4-Trichlorobenzene	0.81	1.8			** 5.9	U	** 6.2	U	** 8.5	U	** 6.6	U
Hexachlorobenzene	0.38	2.3			** 5.9	U	** 6.2	U	** 8.5	U	** 6.6	U
Diethyl Phthalate	61	110			5.9	U	6.2	U	8.5	U	6.6	U
Dimethyl Phthalate	53	53			5.9	U	6.2	U	8.5	U	6.6	U
Di-N-Butyl Phthalate	220	1700			5.9	U	6.2	U	8.5	U	6.6	U
Benzyl Butyl Phthalate	4.9	64			* 5.9	U	* 6.2	U	* 8.5	U	* 6.6	U
Bis(2-Ethylhexyl)Phthalate	47	78			5.9	U	18		19		18	
Di-N-Octyl Phthalate	58	4500			5.9	U	6.2	U	8.5	U	6.6	U
Dibenzofuran	15	58			5.9	U	6.2	U	6.5	U	6.6	U
Hexachlorobutadiene	3.9	6.2			** 12	U	** 12	U	** 17	U	** 13	U
N-Nitrosodiphenylamine	11	11			5.9	U	6.2	U	8.5	U	6.6	U
Total PCBs	12	65	* 14.4		* 129		* 33.5		* 19.4		* 17.5	
Ionizable Organics (ug/Kg-Dry Weight)												
Phenol	420	1200			240	U	240	U	260	U	260	U
2-Methylphenol	63	63			** 240	U	** 240	U	** 260	U	** 260	U
4-Methylphenol	670	670			120	U	120	U	130	U	130	U
2,4-Dimethylphenol	29	29			** 360	U	** 360	U	** 380	U	** 400	U
Pentachlorophenol	360	690			* 600	U	* 600	U	* 640	U	* 660	U
Benzyl Alcohol	57	73			** 600	U	** 600	U	** 640	U	** 660	U
Benzoic Acid	650	650			** 1200	U	** 1200	U	** 1300	U	** 1300	U
Metals (mg/Kg-Dry Weight)												
Arsenic, Total	57	93										
Cadmium, Total	5.1	6.7										
Chromium, Total	260	270										
Copper, Total	390	390										
Lead, Total	450	530										
Mercury, Total	0.41	0.59										
Silver, Total	6.1	6.1										
Zinc, Total	410	960										
Conventionals												
% TOC			1.93		2.02		1.95		1.53		1.97	
Acid Volatile Sulfides (mg/Kg)												
Gravel (%)			0.5		0.3		0.2		0.4		0.3	
Sand (%)			44.9		46		38.1		56.4		55.4	
Silt (%)			46.5		46.9		53.3		40.1		40.8	
Clay (%)			8.2		6.8		8.8		3		3.8	
Fines (%)			54.7		53.7		62.1		43.1		44.6	
Salinity (ppt)												
% Solids			60		55		55		51.7		51.8	

Table 4-3

SEDIMENT CHEMISTRY RESULTS / SMS COMPARISON

Sample ID Laboratory ID Sample Depth (cm) Sample Date	Marine Sediment Standards		NFK313 L7462-13 0-10 12/5/95		NFK314 L7462-14 0-10 12/6/95		NFK315 L7462-15 0-10 12/5/95	
	SQS	CSL	Value	Qual.	Value	Qual.	Value	Qual.
LPAH (mg/Kg-Organic Carbon)	370	780	6.5	U	6.8	U	15	
Naphthalene	99	170	6.5	U	6.8	U	5.2	U
Acenaphthylene	66	66	6.5	U	6.8	U	5.2	U
Acenaphthene	16	57	6.5	U	6.8	U	5.2	U
Fluorene	23	79	6.5	U	6.8	U	5.2	U
Phenanthrene	100	480	6.5	U	6.8	U	5.2	U
Anthracene	220	1200	6.5	U	6.8	U	15	
2-Methylnaphthalene	38	64	6.5	U	6.8	U	5.2	U
HPAH (mg/Kg-Organic Carbon)	960	5300	24		56		130	
Fluoranthene	160	1200	14		20		39	
Pyrene	1000	1400	10		14		22	
Benzo(a)anthracene	110	270	6.5	U	6.8	U	8.8	
Chrysene	110	460	6.5	U	8.3		15	
Total Benzofluoranthenes	230	450	6.5	U	7.3		22	
Benzo(b)fluoranthene			6.5	U	7.3		12	
Benzo(k)fluoranthene			6.5	U	6.8	U	10	
Benzo(a)pyrene	99	210	6.5	U	6.8		11	
Indeno(1,2,3-Cd)Pyrene	34	88	6.5	U	6.8	U	7.2	
Dibenzo(a,h)anthracene	12	33	6.5	U	6.8	U	5.2	U
Benzo(g,h,i)perylene	31	78	6.5	U	6.8	U	8.8	
Other Nonionizable Organics (mg/Kg-Organic Carbon)								
1,2-Dichlorobenzene	2.3	2.3	** 6.5	U	** 6.8	U	** 5.2	U
1,4-Dichlorobenzene	3.1	9	* 6.5	U	* 6.8	U	** 20	
1,2,4-Trichlorobenzene	0.81	1.8	** 6.5	U	** 6.8	U	** 5.2	U
Hexachlorobenzene	0.38	2.3	** 6.5	U	** 6.8	U	** 5.2	U
Diethyl Phthalate	61	110	6.5	U	6.8	U	5.2	U
Dimethyl Phthalate	53	53	6.5	U	6.8	U	5.2	U
Di-N-Butyl Phthalate	220	1700	6.5	U	6.8	U	5.2	U
Benzyl Butyl Phthalate	4.9	64	* 6.5	U	* 6.8	U	* 5.2	U
Bis(2-Ethylhexyl)Phthalate	47	78	10		20		34	
Di-N-Octyl Phthalate	58	4500	6.5	U	6.8	U	5.2	U
Dibenzofuran	15	58	6.5	U	6.8	U	5.2	U
Hexachlorobutadiene	3.9	6.2	** 13	U	** 14	U	** 10.0	U
N-Nitrosodiphenylamine	11	11	6.5	U	6.8	U	5.2	U
Total PCBs	12	65	3.43		5.99		** 19000	
Ionizable Organics (ug/Kg-Dry Weight)								
Phenol	420	1200	240	U	260	U	250	U
2-Methylphenol	63	63	** 240	U	** 260	U	** 250	U
4-Methylphenol	670	670	120	U	130	U	130	U
2,4-Dimethylphenol	29	29	** 360	U	** 400	U	** 380	U
Pentachlorophenol	360	690	* 600	U	* 660	U	* 630	U
Benzyl Alcohol	57	73	** 600	U	** 660	U	** 630	U
Benzoic Acid	650	650	** 1200	U	** 1300	U	** 1300	U
Metals (mg/Kg-Dry Weight)								
Arsenic, Total	57	93						
Cadmium, Total	5.1	6.7						
Chromium, Total	260	270						
Copper, Total	390	390						
Lead, Total	450	530						
Mercury, Total	0.41	0.59						
Silver, Total	6.1	6.1						
Zinc, Total	410	960						
Conventionals								
% TOC			1.84		1.92		2.51	
Acid Volatile Sulfides (mg/Kg)								
Gravel (%)			0.2		0.2		0.3	
Sand (%)			41.7		49.9		60	
Silt (%)			52.6		46.7		35.7	
Clay (%)			6		3.6		4.4	
Fines (%)			58.6		50.3		40.1	
Salinity (ppt)								
% Solids			53.6		48.5		47.9	

Table 4-3
SEDIMENT CHEMISTRY RESULTS / SMS COMPARISON

XXX = Detected chemical exceeds SQS/CSL criteria.
* = Chemical exceeds SQS criteria.
** = Chemical exceeds CSL criteria.
SQS/CSL criteria per Sediment Management Standards, Chapter 173-204.

Qual. = Laboratory qualifier.

Qualifier Code:
- U = Undetected at the method detection limit.
- G = Low standard reference material recovery.
- J = Detected below quantification limits.
- L = High standard reference material recovery.
- B = Blank contamination
- E = Estimate based on high relative percent difference in duplicate, high relative standard deviation in triplicate, or high or low surrogate recoveries.
- X = Biased data based on very low surrogate recoveries or very low matrix spike recoveries.

Table 4-4
SEDIMENT CHEMISTRY RESULTS / AET COMPARISON

Sample ID Laboratory ID Sample Depth (cm) Sample Date	Puget Sound AET Values		NFK UPRIV2 L4321-24 0-10 8/19/94		NFK008 L6725-28 60-90 8/28/95		NFK008 L6725-29 90-120 8/28/95		NFK009 L6725-19 60-90 8/28/95		NFK009 L6725-20 90-120 8/28/95	
	LAET	2LAET	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.
LPAH (ug/Kg-Dry Weight)	5200	13000	51	U	50	U	52	U	49	U	47	U
Naphthalene	2100	2400	51	U	50	UG	52	UG	49	UG	47	UG
Acenaphthylene	1300	1300	19	U	19	U	19	U	18	U	17	U
Acenaphthene	500	730	13	U	13	U	13	U	13	U	12	U
Fluorene	540	1000	19	U	19	U	19	U	18	U	17	U
Phenanthrene	1500	5400	19	UG	19	UG	19	UG	18	UG	17	UG
Anthracene	960	4400	19	U	19	UG	19	UG	18	UG	17	UG
2-Methylnaphthalene			51	U	50	UG	52	UG	49	UG	47	UG
HPAH (ug/Kg-Dry Weight)	12000	17000	51	U	50	U	52	U	49	U	47	U
Fluoranthene	1700	2500	19	U	19	UG	19	UG	18	UG	17	UG
Pyrene	2600	3300	19	UG	19	UG	19	UG	18	UG	17	UG
Benzo(a)anthracene	1300	1600	19	U	19	UG	19	UG	18	UG	17	UG
Chrysene	1400	2800	19	U	19	UG	19	UG	18	UG	17	UG
Total Benzofluoranthenes	3200	3600	51	U	50	U	52	U	49	U	47	U
Benzo(b)fluoranthene			51	U	50	UG	52	UG	49	UG	47	UG
Benzo(k)fluoranthene			51	UL	50	UG	52	UG	49	UG	47	UG
Benzo(a)pyrene	1600	3000	32	UX	31	UG	33	UG	31	UG	29	UG
Indeno(1,2,3-Cd)Pyrene	600	690	32	U	31	UG	33	UG	31	UG	29	UG
Dibenzo(a,h)anthracene	230	540	51	U	50	U	52	U	49	U	47	U
Benzo(g,h,i)perylene	670	720	32	UG	31	UG	33	UG	31	UG	29	UG
Other Nonionizable Organics (ug/Kg-Dry Weight)												
1,2-Dichlorobenzene	35	50	1.5	UBEG	0.8	UG	0.5	U	0.78	UG	0.75	UG
1,4-Dichlorobenzene	110	120	1.5	UBEG	3.71	G	4.14	G	16.2	G	26.4	G
1,2,4-Trichlorobenzene	31	51	1.5	UEG	19	UG	19	UG	18	UG	17	UG
Hexachlorobenzene	22	70	1.5	UEG	0.8	UG	0.5	U	0.78	UG	0.75	U
Diethyl Phthalate	200	1200	32	U	31	U	33	U	31	U	29	U
Dimethyl Phthalate	71	160	13	U	13	U	13	U	13	U	12	U
Di-N-Butyl Phthalate	1400	5100	78.2	BG	31	U,B	33	U,B	83.6	B	29	U,B
Benzyl Butyl Phthalate	63	900	19	U	19	U	19	U	18	U	17	U
Bis(2-Ethylhexyl)Phthalate	1300	1900	25		19	U	19	U	23	J	27	J
Di-N-Octyl Phthalate	6200	6200	19	UL	19	U	19	U	18	U	17	U
Dibenzofuran	540	700	32	U	31	U	33	U	31	U	29	U
Hexachlorobutadiene	11	120	* 32.0	U	* 31.0	UG	* 33.0	UG	* 31.0	UG	* 29	UG
N-Nitrosodiphenylamine	28	40	* 32	U	* 31	U,B	* 33	U,B	* 31	U,B	* 29	U,B
Total PCBs	130	1000	15	U	48.1		16	U	15	U	14	U
Ionizable Organics (ug/Kg-Dry Weight)												
Phenol	420	1200	130	U	130	U	130	U	130	UG	120	U
2-Methylphenol	63	72	32	U	31	U	33	U	31	UG	29	U
4-Methylphenol	670	1800	32	U	31	U	33	U	31	UG	29	U
2,4-Dimethylphenol	29	72	* 32.0	U	* 31.0	UG	* 33.0	UG	* 31.0	UG	29	UG
Pentachlorophenol	360	690	32	U	31	U	33	U	31	UG	29	U
Benzyl Alcohol	57	73	32	U	31	UG	33	UG	31	UG	29	UG
Benzoic Acid	650	760	130	U	130	UE	130	UE	130	UEG	120	UE
Conventionals												
% TOC			0.0675		0.0404		0.0274		0.0671		0.0292	
% Solids			84		86.2		82.9		87.9		91.9	

XXX = Detected chemical exceeds LAET/2LAET criteria.
* = Chemical exceeds LAET criteria.
** = Chemical exceeds 2LAET criteria.
AET values per Barrick et al. 1988.
LAET = Lowest AET value.
2LAET = Second lowest AET value.

Qual. = Laboratory qualifier.

Qualifier Code:
U = Undetected at the method detection limit.
G = Low standard reference material recovery.
J = Detected below quantification limits.
L = High standard reference material recovery.
B = Blank contamination
E = Estimate based on high relative percent difference in duplicate, high relative standard deviation in triplicate, or high or low surrogate recoveries.
X = Biased data based on very low surrogate recoveries or very low matrix spike recoveries.

Table 4-4
SEDIMENT CHEMISTRY RESULTS / AET COMPARISON

Sample ID Laboratory ID Sample Depth (cm) Sample Date	Puget Sound AET Values		NFK012 L4321-13 0-10 8/18/94		NFK013 L4321-14 0-10 8/19/94		NFK014 L4321-15 0-10 8/19/94		NFK1992 L6725-38 90-120 8/23/95		NFK1992 FD L6725-45 30-60 8/23/95	
	LAET	2LAET	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.
LPAH (ug/Kg-Dry Weight)	5200	13000	53	U	55	U	52	U	47	U	47	U
Naphthalene	2100	2400	53	U	55	U	52	U	47	UG	47	UG
Acenaphthylene	1300	1300	20	U	21	U	19	U	18	U	17	UG
Acenaphthene	500	730	14	U	14	U	13	U	12	U	12	UG
Fluorene	540	1000	20	U	21	U	19	U	18	U	17	UG
Phenanthrene	1500	5400	20	UG	21	UG	19	UG	18	UG	17	UG
Anthracene	960	4400	20	UG	21	UG	19	UG	18	UG	17	UG
2-Methylnaphthalene			53	U	55	U	52	U	47	UG	47	UG
HPAH (ug/Kg-Dry Weight)	12000	17000	597		78		44		47	U	47	U
Fluoranthene	1700	2500	86	G	21	UG	20	G	18	UG	17	UG
Pyrene	2600	3300	69.8	G	24	G	24	G	18	UG	17	UG
Benzo(a)anthracene	1300	1600	74.9	G	27	G	19	UG	18	UG	17	UG
Chrysene	1400	2800	66.2		27	J	19	U	18	UG	17	UG
Total Benzofluoranthenes	3200	3600	187		55	U	52	U	47	U	47	U
Benzo(b)fluoranthene			108		55	U	52	U	47	UG	47	UG
Benzo(k)fluoranthene			79	J	55	U	52	U	47	UG	47	UG
Benzo(a)pyrene	1600	3000	53	G	35	UG	32	UG	30	UG	29	UG
Indeno(1,2,3-Cd)Pyrene	600	690	38	G	35	UG	32	UG	30	UG	29	UG
Dibenzo(a,h)anthracene	230	540	53	UG	55	UG	52	UG	47	U	47	UG
Benzo(g,h,i)perylene	670	720	33	UG	35	UG	32	UG	30	UG	29	UG
Other Nonionizable Organics (ug/Kg-Dry Weight)												
1,2-Dichlorobenzene	35	50	1.6	UEG	1.7	UEG	1.6	UEG	0.76	UG	0.75	UG
1,4-Dichlorobenzene	110	120	1.6	UBEG	2.3	BEG	1.7	BEG	0.76	UG	0.75	UG
1,2,4-Trichlorobenzene	31	51	1.6	UEG	1.7	UEG	1.6	UEG	18	UG	17	UG
Hexachlorobenzene	22	70	1.6	UEG	1.7	UEG	1.6	UEG	0.76	UG	0.75	UG
Diethyl Phthalate	200	1200	33	U	35	U	32	U	30	U	29	UG
Dimethyl Phthalate	71	160	14	U	14	U	13	U	12	U	12	UG
Di-N-Butyl Phthalate	1400	5100	114	B	105	B	70.4	B	31	J,B	39	J,B,G
Benzyl Butyl Phthalate	63	900	*81.3		31	J	19	U	18	U	17	UG
Bis(2-Ethylhexyl)Phthalate	1300	1900	484		93.1		81.5		22	J	20	JG
Di-N-Octyl Phthalate	6200	6200	20	UL	21	UL	19	UL	18	U	17	UG
Dibenzofuran	540	700	33	U	35	U	32	U	30	U	29	UG
Hexachlorobutadiene	11	120	*33	UG	*35.0	UG	*32.0	UG	*30.0	UG	*29.0	UG
N-Nitrosodiphenylamine	28	40	*33	U	*35	U	*32	U	*30	U,B	*29	U,B,G
Total PCBs	130	1000	16	U	17	U	16	U	14	U	14	U
Ionizable Organics (ug/Kg-Dry Weight)												
Phenol	420	1200	140	U	140	U	130	U	120	U	120	UG
2-Methylphenol	63	72	33	U	35	U	32	U	30	U	29	UG
4-Methylphenol	670	1800	33	U	35	U	32	U	30	U	29	UG
2,4-Dimethylphenol	29	72	*33	U	*35.0	U	*32.0	U	*30.0	UG	29	UG
Pentachlorophenol	360	690	33	U	35	U	32	U	30	U	29	UG
Benzyl Alcohol	57	73	33	U	35	U	32	U	30	UG	29	UG
Benzoic Acid	650	760	140	U	140	U	130	U	120	UE	120	UEG
Conventionals												
% TOC			0.178		0.18		0.069		0.0678		0.0795	
% Solids			80.8		77.7		83.1		91		91.6	

XXX = Detected chemical exceeds LAET/2LAET criteria.
* = Chemical exceeds LAET criteria.
** = Chemical exceeds 2LAET criteria.

AET values per Barrick et al. 1988.
LAET = Lowest AET value.
2LAET = Second lowest AET value.

Qual. = Laboratory qualifier.

Qualifier Code:
- U = Undetected at the method detection limit.
- G = Low standard reference material recovery.
- J = Detected below quantification limits.
- L = High standard reference material recovery.
- B = Blank contamination
- E = Estimate based on high relative percent difference in duplicate, high relative standard deviation in triplicate, or high or low surrogate recoveries.
- X = Biased data based on very low surrogate recoveries or very low matrix spike recoveries.

Table 4-4
SEDIMENT CHEMISTRY RESULTS / AET COMPARISON

Sample ID / Laboratory ID / Sample Depth (cm) / Sample Date	Puget Sound AET Values		NFK207 L6725-10 60-90 8/28/95		NFK207 L6725-11 90-120 8/28/95		NFK207 L6725-9 30-60 8/28/95		NFK302 L7462-2 0-10 12/6/95	
	LAET	2LAET	Value	Qual.	Value	Qual.	Value	Qual.	Value	Qual.
LPAH (ug/Kg-Dry Weight)	5200	13000	50	U	54	U	174		72	U
Naphthalene	2100	2400	50	UG	54	UG	48	UG	72	U
Acenaphthylene	1300	1300	20	UG	20	U	18	UG	72	U
Acenaphthene	500	730	14	UG	14	U	29.3	G	72	U
Fluorene	540	1000	20	UG	20	U	18	UG	72	U
Phenanthrene	1500	5400	20	UG	20	UG	116	G	72	U
Anthracene	960	4400	20	UG	20	UG	29	JG	72	U
2-Methylnaphthalene			50	UG	54	UG	48	UG	72	U
HPAH (ug/Kg-Dry Weight)	12000	17000	50	U	54	U	1310		72	U
Fluoranthene	1700	2500	20	UG	20	UG	271	G	72	U
Pyrene	2600	3300	20	UG	20	UG	234	G	72	U
Benzo(a)anthracene	1300	1600	20	UG	20	UG	97.4	G	72	U
Chrysene	1400	2800	20	UG	20	UG	112	G	72	U
Total Benzofluoranthenes	3200	3600	50	U	54	U	180		72	U
Benzo(b)fluoranthene			50	UG	54	UG	120	G	72	U
Benzo(k)fluoranthene			50	UG	54	UG	57	JG	72	U
Benzo(a)pyrene	1600	3000	34	UG	34	UG	116	G	72	U
Indeno(1,2,3-Cd)Pyrene	600	690	34	UG	34	UG	153	G	72	U
Dibenzo(a,h)anthracene	230	540	50	UG	54	U	48	UG	72	U
Benzo(g,h,i)perylene	670	720	34	UG	34	UG	143	G	72	U
Other Nonionizable Organics (ug/Kg-Dry Weight)										
1,2-Dichlorobenzene	35	50	0.86	UG	0.86	UG	0.78	UG	** 72	U
1,4-Dichlorobenzene	110	120	2.06	G	0.86	UG	16.8	G	72	U
1,2,4-Trichlorobenzene	31	51	20	UG	20	UG	18	UG	** 72	U
Hexachlorobenzene	22	70	0.86	UG	0.86	U	0.78	UG	** 72	U
Diethyl Phthalate	200	1200	34	UG	34	U	30	UG	72	U
Dimethyl Phthalate	71	160	10	UG	10	U	12	UG	* 72	U
Di-N-Butyl Phthalate	1400	5100	74.5	BG	93.5	B	45	J,B,G	72	U
Benzyl Butyl Phthalate	63	900	20	UG	20	U	18	UG	* 72	U
Bis(2-Ethylhexyl)Phthalate	1300	1900	20	JG	24	J	132	G	72	U
Di-N-Octyl Phthalate	6200	6200	20	UG	20	U	18	UG	72	U
Dibenzofuran	540	700	34	UG	34	U	30	UG	72	U
Hexachlorobutadiene	11	120	* 34.0	UG	* 34.0	UG	* 30	UG	** 140	U
N-Nitrosodiphenylamine	28	40	* 34	U,B,G	* 34	U,B	* 30	U,B,G	** 72	U
Total PCBs	130	1000	16	U	16	U	15	U	16	
Ionizable Organics (ug/Kg-Dry Weight)										
Phenol	420	1200	100	UG	100	U	120	U	140	U
2-Methylphenol	63	72	34	UG	34	U	30	U	** 140	U
4-Methylphenol	670	1800	34	UG	34	U	30	U	72	U
2,4-Dimethylphenol	29	72	* 34.0	UG	* 34.0	UG	* 30	UG	** 220	U
Pentachlorophenol	360	690	34	UG	34	U	30	U	360	U
Benzyl Alcohol	57	73	34	UG	34	UG	30	UG	** 360	U
Benzoic Acid	650	760	100	UEG	100	UE	140	JE	* 720	U
Conventionals										
% TOC			0.0914		0.0302		0.158		0.0317	
% Solids			80		80.1		88.8		93.8	

XXXG = Detected chemical exceeds LAET/2LAET criteria.
* = Chemical exceeds LAET criteria.
** = Chemical exceeds 2LAET criteria.
AET values per Barrick et al. 1988.
LAET = Lowest AET value.
2LAET = Second lowest AET value.

Qual. = Laboratory qualifier.

Qualifier Code:
U = Undetected at the method detection limit.
G = Low standard reference material recovery.
J = Detected below quantification limits.
L = High standard reference material recovery.
B = Blank contamination
E = Estimate based on high relative percent difference in duplicate, high relative standard deviation in triplicate, or high or low surrogat
X = Biased data based on very low surrogate recoveries or very low matrix spike recoveries.

4.4.1 Conventionals

4.4.1.1 Salinity

Four preliminary interstitial salinity samples were collected in 1994 prior to Phase 1 to guide the selection of bioassay organisms, and determine whether comparison to marine sediment criteria was appropriate. Salinity measurements ranged from 3 to 9 parts per thousand (ppt), and are defined by SMS as low salinity sediments (i.e., 0.5 to 25 ppt). These samples were collected during low tide, when the lowest salinities were expected.

Phase 1 salinity data for upriver stations (NFKUPRIV1, NFKUPRIV2, NFK010) ranged from 14 to 22 ppt, while stations located adjacent to or downstream of the outfall ranged from 5 to 16 ppt. These data confirm the low-salinity sediment designation for the outfall study area.

4.4.1.2 Total Organic Carbon

Surface sediment TOC concentrations ranged from 0.03 to 4.01 percent; for comparison, a range of 0.5 to 3 percent is typical for Puget Sound marine sediments (Michelsen, 1992). **Figure 4-2** illustrates the spatial distribution of TOC values.

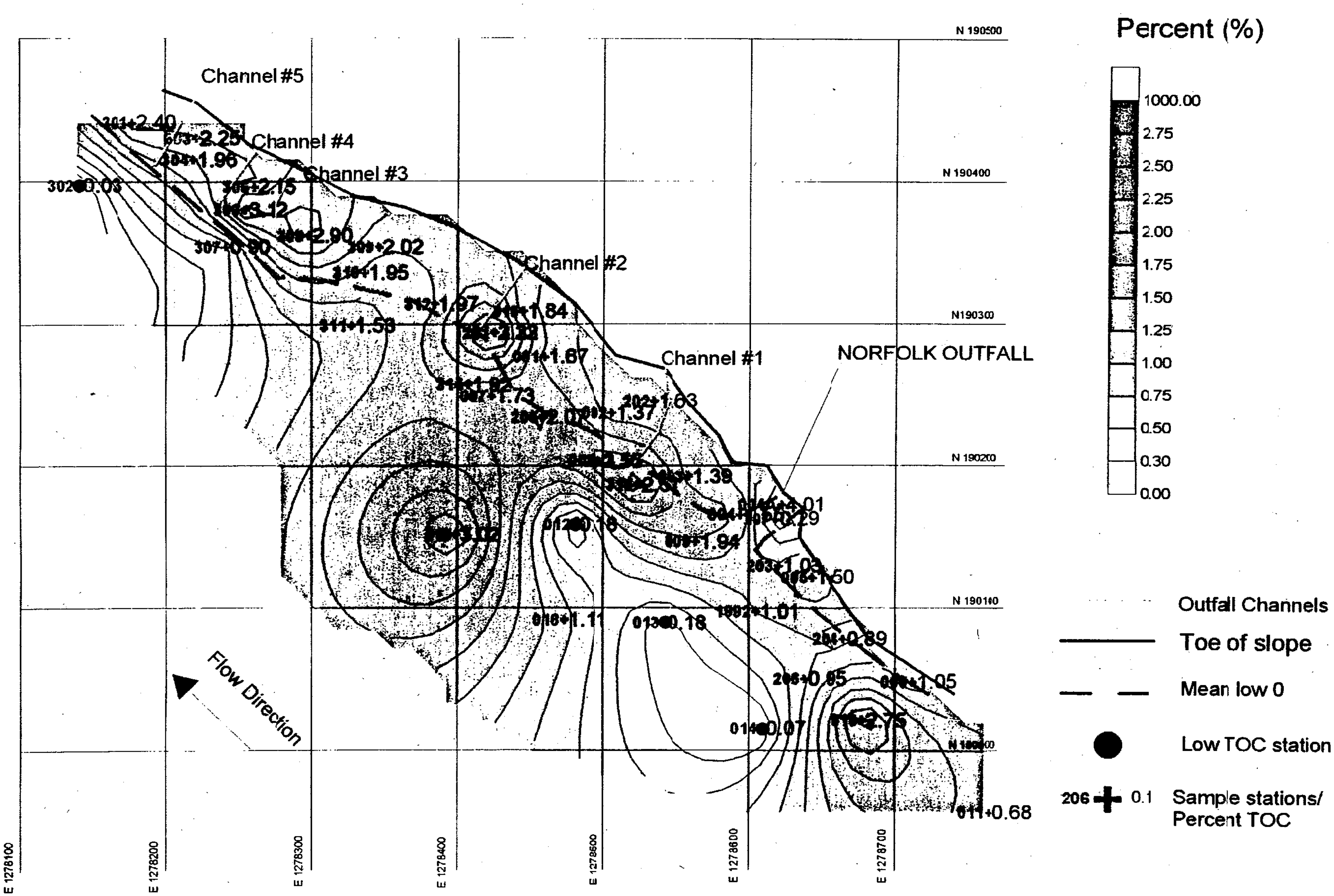
The following Norfolk surface sediment stations are characterized by low TOC concentrations (<0.2 percent) and are compared to AET values in addition to SMS criteria:

- NFKUPRIV2
- NFK012
- NFK013
- NFK014
- NFK302

These stations are located in the subtidal river channel and are dominated by coarse-grained sediment (refer to **Chapter 4.4.1.3**).

4.4.1.3 Particle Size Distribution

Particle size distribution data are reported in **Table 4-3** as percentages of gravel, sand, silt, and clay. In addition, the distribution of percent fines (silt + clay) is illustrated in **Figure 4-3**, to indicate areas of deposition and scouring. Generally, the coarsest sediments identified in the study area (<5 percent fines) were located in the subtidal river channel (e.g., NFK012 through NFK016, and NFK302), and probably reflects greater scouring action from river flow. Finer sediments (> 60 percent fines) were located at intertidal stations (e.g., NFK004a, NFK202, NFK310) where sediment deposition appears more pronounced.

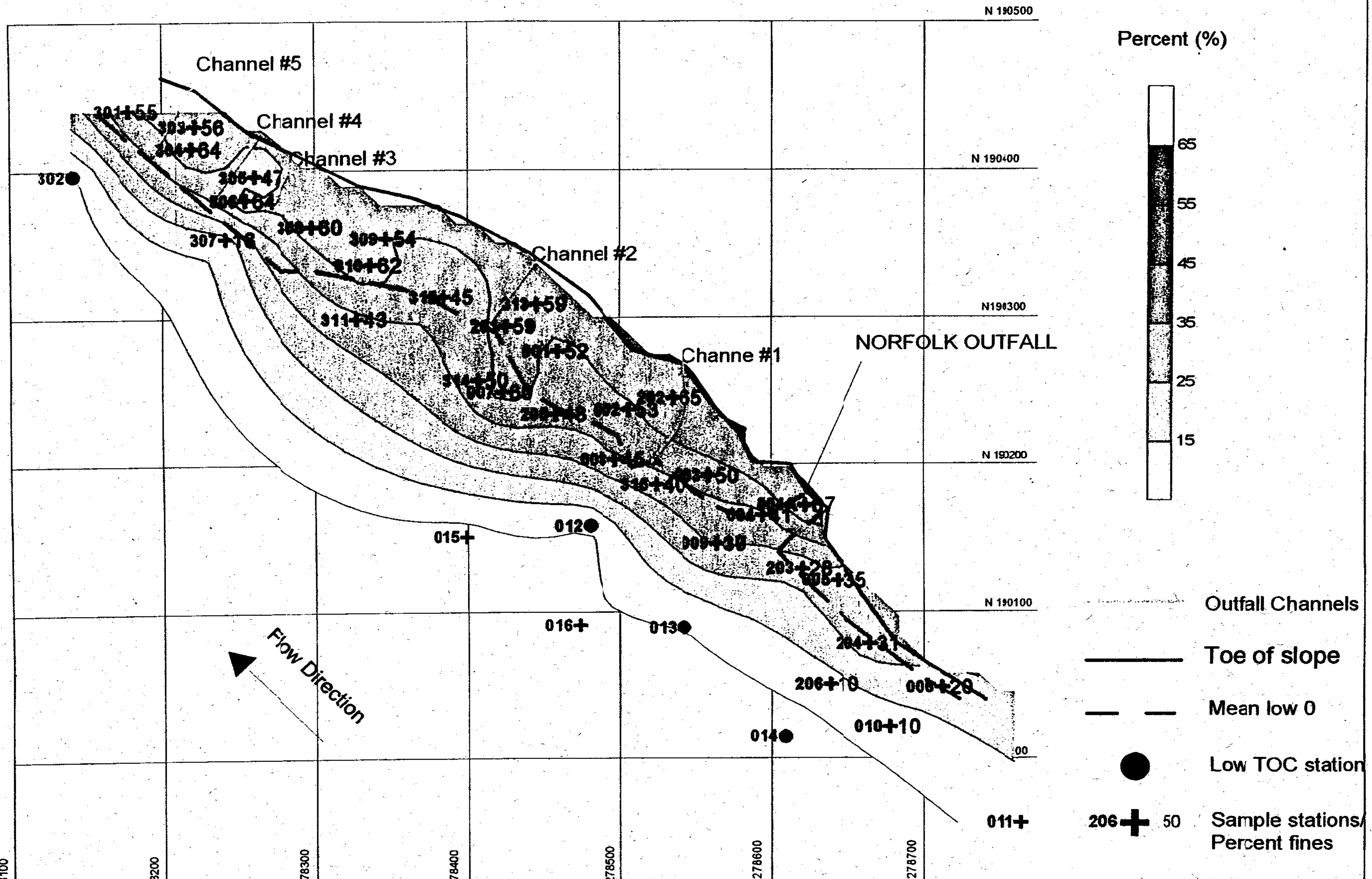


EcoChem Team

Norfolk Sediment Cleanup Study

Concentration Contours of Total Organic Carbon in surface sediment

Figure 4-2



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Norfolk Sediment Cleanup Study

Contours of fines in surface sediments

Figure 4-3

4.4.2 Inorganics

Table 4-5 presents a summary of SMS exceedences of detected inorganic chemicals. Mercury was the only inorganic chemical to exceed SMS criteria, with exceedances of CSL criteria at two stations. Methyl mercury represented a small fraction (0.03 to 3.1 percent) of the total mercury content, based on Phase 1 measurements at the bioassay stations (**Appendices B and D**). Mercury also exceeded the CSL at two of three pre-Phase 1 sediment stations (**Appendix A**).

Table 4-5
SUMMARY OF SURFACE SEDIMENT EXCEEDANCES OF SMS CRITERIA OR AET VALUES[a]

Chemical	Stations Exceeding SQS Only[b]	Stations Exceeding CSL[b]
Mercury		NFK008 NFK203
Total PCBs	NFK001 NFK009 NFK201 NFK202 NFK205 NFK304 NFK306 NFK307 NFK308 NFK309 NFK310 NFK311 NFK312	NFK008 NFK201 NFK305 NFK315
1,4-Dichlorobenzene	NFK004	NFK009 NFK203 NFK315
Bis (2-ethylhexyl) phthalate	NFK004a NFK005	NFK008 NFK009 NFK203
Benzyl butyl phthalate	NFK203 NFK012[c]	
Phenanthrene	NFK006	
Indeno (1,2,3-cd) pyrene	NFK006	
Dibenzo (a,h) anthracene	NFK006	
Benzo (g,h,i) perylene	NFK203	
Benzoic acid		NFK202

Footnotes:

[a]Exceedences based on detected chemicals only.

[b]SQS/CSL exceedances are reported for stations with TOC concentrations >0.2 percent.

[c]LAET/2LAET exceedances are reported for stations with TOC concentrations <0.2 percent.

Other Notes:

SMS: Sediment Management Standards, WAC 173-204
SQS: Sediment Quality Standards, WAC 173-204-320
CSL: Cleanup Screening Levels, WAC 173-204-520
LAET: Lowest Apparent Effects Threshold, PSEP 1988
2LAET: Second Lowest AET Value

4.4.3 Organics

Table 4-5 presents a summary of SMS/AET exceedances for detected organic chemicals. This summary is based on SMS comparisons for surface sediment stations with TOC concentrations >0.2 percent, and AET comparisons for surface sediment stations with TOC concentrations <0.2

percent. Four organic chemicals (Total PCBs, 1,4-dichlorobenzene, bis (2-ethylhexyl) phthalate, and benzoic acid) exceeded CSL criteria. The PCB detections at Stations NFK305 and NFK315 were significant, exceeding the CSL criteria by factors of 160 and 292, respectively. Eight organic chemicals exceeded SQS criteria only; however, three of the SQS exceedances were due to various PAHs at station NFK006, which is located upgradient and removed from the influence of the Norfolk CSO outfall source area. Method blank contamination associated with exceedances of 1,4-dichlorobenzene and bis (2-ethylhexyl) phthalate did not affect sample results (EBDRP, 1995c; **Appendix D**), since method blank concentrations were much lower than sample results.

For those surface sediment stations exhibiting TOC concentrations <0.2 percent, a detection of butyl benzyl phthalate at Station NFK012 exceeded the corresponding LAET value by a factor of 1.3. No other chemicals exceeded LAET/2LAET values at low TOC stations.

Stations with low TOC concentrations also exhibited several exceedances of SMS criteria for undetected nonionizable organics, based on detection limit values (**Table 4-3**). However, when compared to AET values, the detection limits were generally below LAETs with the exception of hexachlorobutadiene.

4.5 SUBSURFACE SEDIMENT RESULTS

Table 4-3 includes subsurface sediment chemistry data for conventionals and SMS chemicals. Similar to the surface sediment presentation, concentrations of SMS chemicals are compared to SMS criteria. If TOC values are less than 0.2 percent, SMS chemicals are also compared to AET values (**Table 4-4**). Evaluation of sediment core data for waste disposal purposes is presented in **Appendix K**.

During Phase 1, one core (NFK009$_{Ph1}$) was collected and sectioned into four segments (0 to 15 cm, 15 to 30 cm, 30 to 45 cm, and 45 to 60 cm). During Phase 2, four cores (NFK008, NFK009$_{Ph2}$, NFK1992, NFK207) were collected, and each core was sectioned into four segments (0 to 30 cm, 30 to 60 cm, 60 to 90 cm, and 90 to 120 cm; or 0 to 1 foot, 1 to 2 foot, 2 to 3 foot, and 3 to 4 foot) for comparison to SMS criteria. The following discussion focuses on the Phase 2 core data, since this provides more chemical data at greater depths. It should be recognized that the sediment coring effort was limited to an area around the Norfolk outfall, and that subsurface chemistry data for downstream Phase 3 stations are lacking.

4.5.1 Conventionals

4.5.1.1 Total Organic Carbon

TOC concentrations ranged between 0.28 to 2.15 percent in the upper section (0 to 30 cm). TOC concentrations generally decreased with depth, ranging between 0.02 to 0.06 percent in the deepest core sections (90 to 120 cm).

The following Norfolk core sections are characterized by low TOC concentrations (<0.2 percent) and were compared to AET values in addition to SMS criteria:

- NFK008 (60 to 90), (90 to 120)
- NFK009$_{Ph2}$ (60 to 90), (90 to 120)
- NFK1992 (30 to 60),(90 to 120); [For comparison, the 60 to 90 cm section has a TOC concentration of 1.34 percent]
- NFK207 (30 to 60), (60 to 90), (90 to 120)

4.5.1.2 Particle Size Distribution

Sand was the dominant fraction (>50 percent) in all core sections, and increased with sample depth. The sand fraction ranged from 51 to 80 percent in surface sections (0 to 30 cm), and increased to 93 to 96 percent in the deepest core sections (90 to 120 cm). Conversely, percent fines (silt + clay) ranged from 9.4 to 49.2 percent in surface core sections, and decreased to 2.9 to 6.7 percent in bottom core sections.

4.5.2 Inorganics

Table 4-6 presents a summary of SMS criteria exceedences for detected inorganic chemicals. Similar to surface sediments, mercury was the only inorganic chemical to exceed SMS criteria (at two stations) in subsurface core sections. No mercury exceedances were reported below a 60-cm (2-foot) depth.

4.5.3 Organics

Table 4-6 presents a summary of SMS/AET exceedances for detected organic chemicals. This summary is based on SMS comparisons for core sections with TOC concentrations >0.2 percent, and AET comparisons for core sections with TOC concentrations <0.2 percent. A total of 16 organic chemicals exceeded SMS criteria, of which 12 chemicals (primarily PAHs) were associated with exceedances at a single core station (NFK207, 0 to 30 cm). This core station is located within the Norfolk outfall channel, and also exhibits a relatively low TOC concentration of 0.28 percent. For those core stations exhibiting TOC concentrations <0.2 percent, there were no corresponding exceedances of LAET values.

In conclusion, there were no exceedances of SMS criteria or AET values at the upgradient core station NFK1992, or below a 60-cm (2-foot) depth in any core station located adjacent to or downgradient of the Norfolk CSO outfall. This is based on using appropriate comparisons (i.e., using AET values for evaluating core sections with TOC <0.2 percent). Therefore, chemical characterization of sediment cores have been adequately defined for remediation purposes.

Table 4-6
SUMMARY OF SEDIMENT CORE EXCEEDANCES OF SMS CRITERIA OR AET VALUES[a]

Chemical	Station Cores Exceeding SQS Only[b]	Station Cores Exceeding CSL[b]
Mercury	$NFK009_{Ph2}$ (0 to 30)	NFK008 (30 to 60) $NFK009_{Ph1}$ (15 to 30)
Total PCBs	NFK008 (0 to 30) $NFK009_{Ph1}$ (15 to 30) $NFK009_{Ph2}$ (0 to 30) NFK207 (0 to 30)	NFK008 (30 to 60)
1,4-Dichlorobenzene		$NFK009_{Ph1}$(0 to 15), (15 to 30), (30 to 45), (45 to 60) $NFK009_{Ph2}$(0 to 30), (30 to 60) NFK207 (0 to 30)
Bis (2-ethylhexyl) phthalate		$NFK009_{Ph1}$(0 to 15), (30 to 45) $NFK009_{Ph2}$ (0 to 30) NFK207 (0 to 30)
Benzyl butyl phthalate	$NFK009_{Ph1}$(0 to 15), (45 to 60) NFK207 (0 to 30)	
Acenaphthene	NFK207 (0 to 30)	
Phenanthrene	NFK207 (0 to 30)	
Fluoranthene	NFK207 (0 to 30)	
Benzo(a)anthracene		NFK207 (0 to 30)
Chrysene	NFK207 (0 to 30)	
Total Benzofluoranthenes		NFK207 (0 to 30)
Benzo(a)pyrene		NFK207 (0 to 30)
Indeno (1,2,3-cd) pyrene		NFK207 (0 to 30)
Dibenzo (a,h) anthracene		NFK207 (0 to 30)
Benzo (g,h,i) perylene		NFK207 (0 to 30)
Total HPAHs	NFK207 (0 to 30)	
N-Nitrosodiphenylamine		NFK207 (0 to 30)

Footnotes:

[a]Exceedence based on detected chemicals only.

[b]SQS/CSL exceedances are reported for stations with TOC concentrations >0.2 percent.

Other Notes:

(0 to 30) Core section in centimeters.
SMS: Sediment Management Standards, WAC 173-204
SQS: Sediment Quality Standards, WAC 173-204-320
CSL: Cleanup Screening Levels, WAC 173-204-520
LAET: Lowest Apparent Effects Threshold, PSEP 1988
2LAET: Second Lowest AET Value

5.0 DATA INTERPRETATION

5.1 CHEMICALS OF CONCERN

5.1.1 Selection Criteria

As an element of the 1991 Consent Decree agreement, the EBDRP Panel was directed to use Washington State sediment standards to determine the level of sediment cleanup. Therefore, identification of chemicals of concern (COCs) for the Norfolk CSO site was based on comparison to SMS criteria (WAC 173-204), which includes both chemical and biological effects criteria. Since Phase 1 bioassay data were rejected for this report, COC identification was based strictly on exceedances of SMS chemical criteria (i.e., SQS and CSL concentrations). An exception to this approach was employed at stations with low TOC concentrations (<0.2 percent), where nonionizable organic chemicals were compared to dry weight AET values to identify COCs.

The SMS provides for site cleanup standards that may range from SQS to CSL/MCUL criteria, based on an evaluation of associated cost and net environmental benefits. Therefore, estimation of the areas of contaminated sediments above SQS <u>and</u> above CSL/MCUL concentrations is the first step in determining cleanup standards for the Norfolk CSO site.

5.1.2 Chemicals of Concern from Norfolk CSO

The surface sediment characterization (**Chapter 4.4**) identified four chemicals of concern (mercury, 1,4-dichlorobenzene, bis(2-ethylhexyl)phthalate, and PCBs) around the Norfolk CSO outfall based on exceedances of CSL criteria. Although core data for station NFK207 (located within the Norfolk outfall channel) showed exceedances of SMS criteria for several PAHs in the surface section (0 to 30 cm), PAHs were not evaluated further as COCs. This is due to the fact that PAH exceedances were generally limited to this single core section, and therefore PAHs were not considered a widespread problem in the study area.

Benzoic acid exceeded the CSL at one downstream station (NFK202), and three PAHs exceeded SQS criteria at one upstream station (NFK006); however, the position of these stations does not indicate association with the Norfolk outfall. Station NFK202 is located at the base of a heavily vegetated slope and NFK006 is located next to a large wooded barge made of treated wood. These chemicals are not identified as COCs from the Norfolk CSO.

For data interpretation, SURFER contour concentration maps were generated for each COC using kriging methods. Generally, kriging creates the best overall interpretation of most data sets (Golden Software, 1994). Calculation of areas exceeding SQS and CSL criteria in the contour maps were determined by Arcview GIS methods. Results of the concentration contouring are discussed for each COC.

5.1.2.1 Mercury

Figure 5-1 illustrates the concentration contours for total mercury in surface sediment. The surface pattern indicates two areas of exceedances. One area is at NFK203 (3.72 mg/kg), which is located adjacent to the Norfolk CSO outfall channel. A smaller area at NFK008 (0.84 mg/kg), located downstream of the Norfolk outfall, appears independent from the CSO footprint based upon the low mercury concentrations reported in between these two hotspots. Since mercury was not tested during Phase 3, it is not plotted for the downstream Phase 3 stations (NFK301 to NFK315).

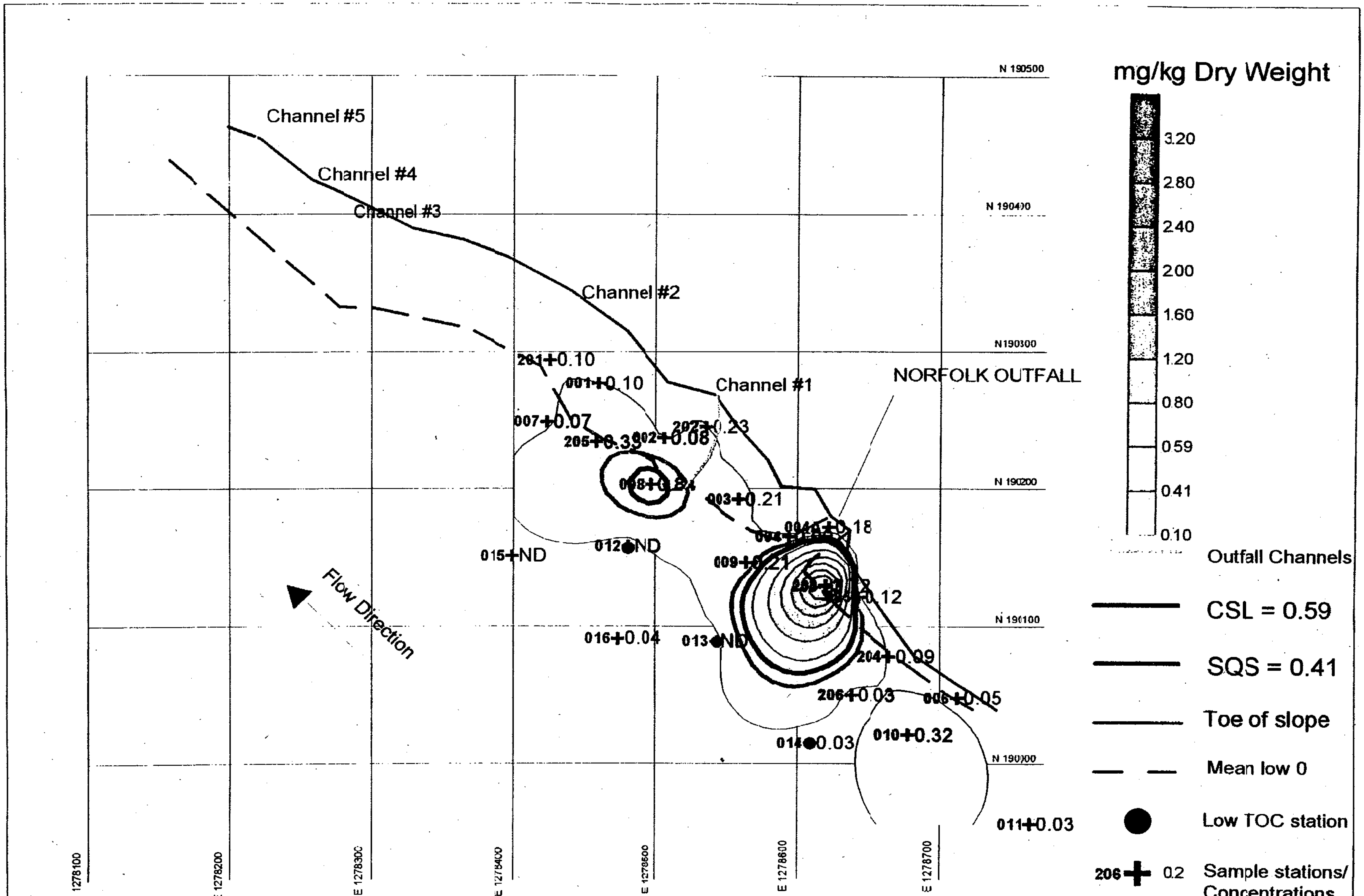
The total surface area exceeding mercury SQS/CSL criteria is combined with other COCs to define the total surface area exceedances (refer to **Chapter 5.1.2.5**). As indicated by Phase 2 coring data (**Chapter 4.5**), mercury did not exceed SMS criteria below 2-foot depth in any core, including one core station located at the NFK008 hotspot.

Available data for characterizing source contributions of mercury are limited. Data presented in the *Pollutant Loading Analyses for the Elliott Bay Waterfront Recontamination Study* (Herrera Environmental Consultants, 1995) identified a mercury concentration range of 0.38 to 3.22 mg/kg in sediments collected from within KCWPCD and City CSOs. The same study presented geometric mean mercury concentrations of 0.2 to 0.26 mg/kg in particulate material discharged from storm drains from residential, commercial, and industrial areas. Mercury has been used as a marker of the extent of sediment contamination resulting from untreated sewage discharges in British Columbia (Chapman et. al., 1996). Finally, the Norfolk regulator was sampled four times during overflow events in 1988 through 1991, and mercury was detected during all four events at concentrations between 0.0002 and 0.0007 mg/L. Modeling results indicate that after source control (of volume), the sediment concentrations are projected to be less than SQS even if the mercury concentration in the outflow stays the same.

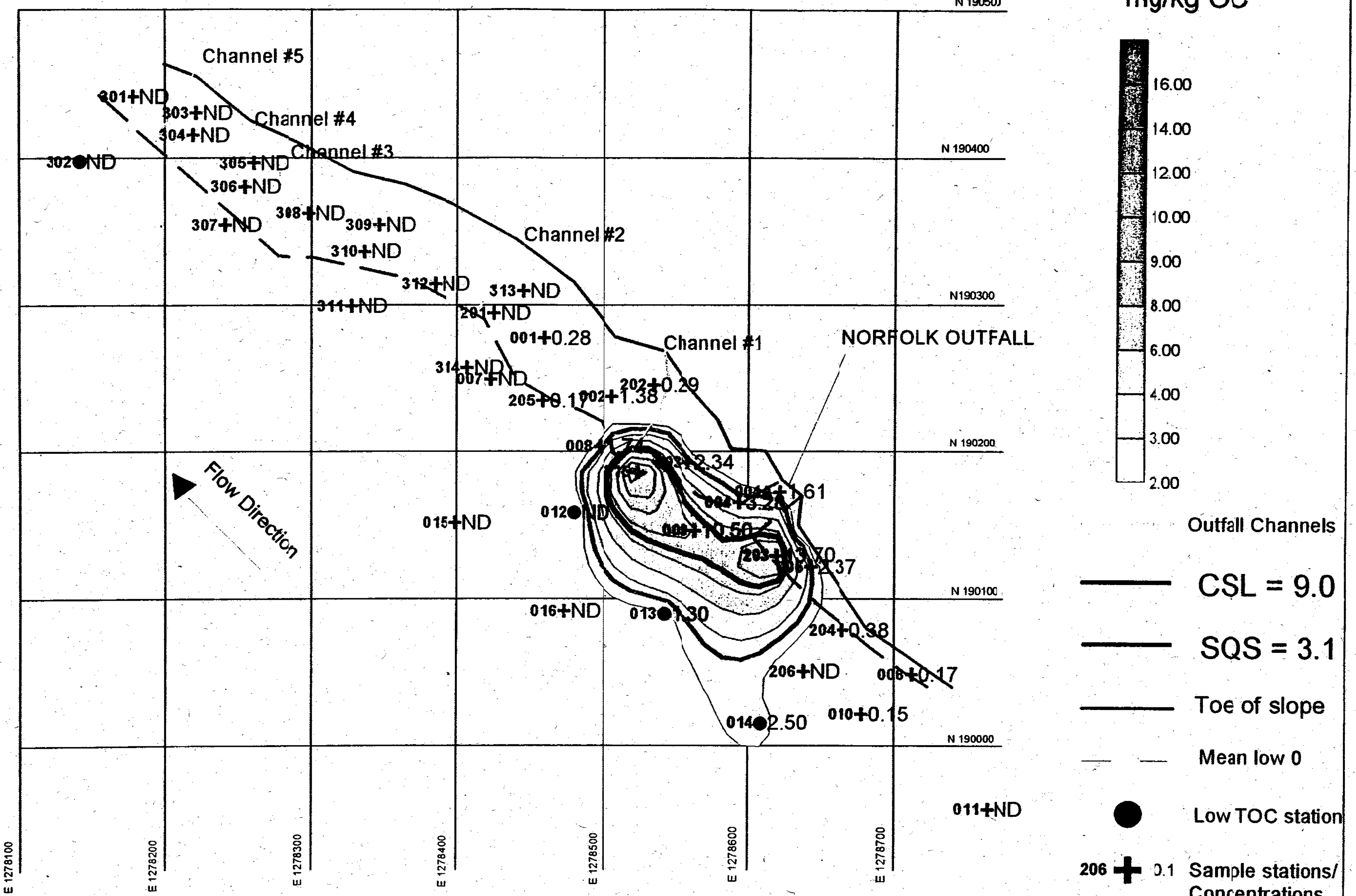
5.1.2.2 1,4-Dichlorobenzene

Figure 5-2 illustrates the concentration contours for 1,4-dichlorobenzene in surface sediment. The surface pattern indicates a CSL exceedance contour extending from station NFK203 (located adjacent to the Norfolk CSO outfall channel), extending downstream through station NFK009, and ending after station NFK315 (which is located at the channel mouth of Outfall Channel #1). The downstream limit to the SQS contour (which represents the downstream limit of the CSO footprint) extends slightly further, but appears to end prior to stations NFK008 and NFK202. Since the concentration of 1,4-dichlorobenzene (both OC-normalized and DW) at downstream station NFK315 exceeds the concentration at upstream stations NFK009 and NFK203, there is the possibility that the downstream station has received additional input from the Boeing outfall. However, there is no data to confirm this. Finally, the concentration contours were not affected by low TOC stations (i.e., NFK012, NFK013, NFK014, NFK302), which exhibited low 1,4-dichlorobenzene concentrations.

The total surface area exceeding 1,4-dichlorobenzene SQS/CSL criteria is combined with other COCs to define the total surface area exceedances (refer to **Chapter 5.1.2.5**). As indicated by Phase 2 coring data (**Chapter 4.5**), 1,4-dichlorobenzene did exceed SMS criteria below 2-foot depth at coring stations NFK008 and NFK009; however, the deeper core sections exhibited low TOC, and additional comparison to dry-weight LAET values showed no exceedances. At core



EcoChem Team	Norfolk Sediment Cleanup Study Concentration Contours of Total Mercury in surface sediments	Figure 5-1



EcoChem Team

Norfolk Sediment Cleanup Study

Concentration Contours of 1,4-Dichlorobenzene in surface sediments

Figure 5-2

station NFK009, the dry-weight concentration was greatest in the 1- to 2-foot core section (91.4 μg/kg), but decreased to 16.2 μg/kg (2- to 3-foot section) and to 26.4 μg/kg (3- to 4-foot section). Therefore, depth of sediment contamination is assumed to be 2 feet.

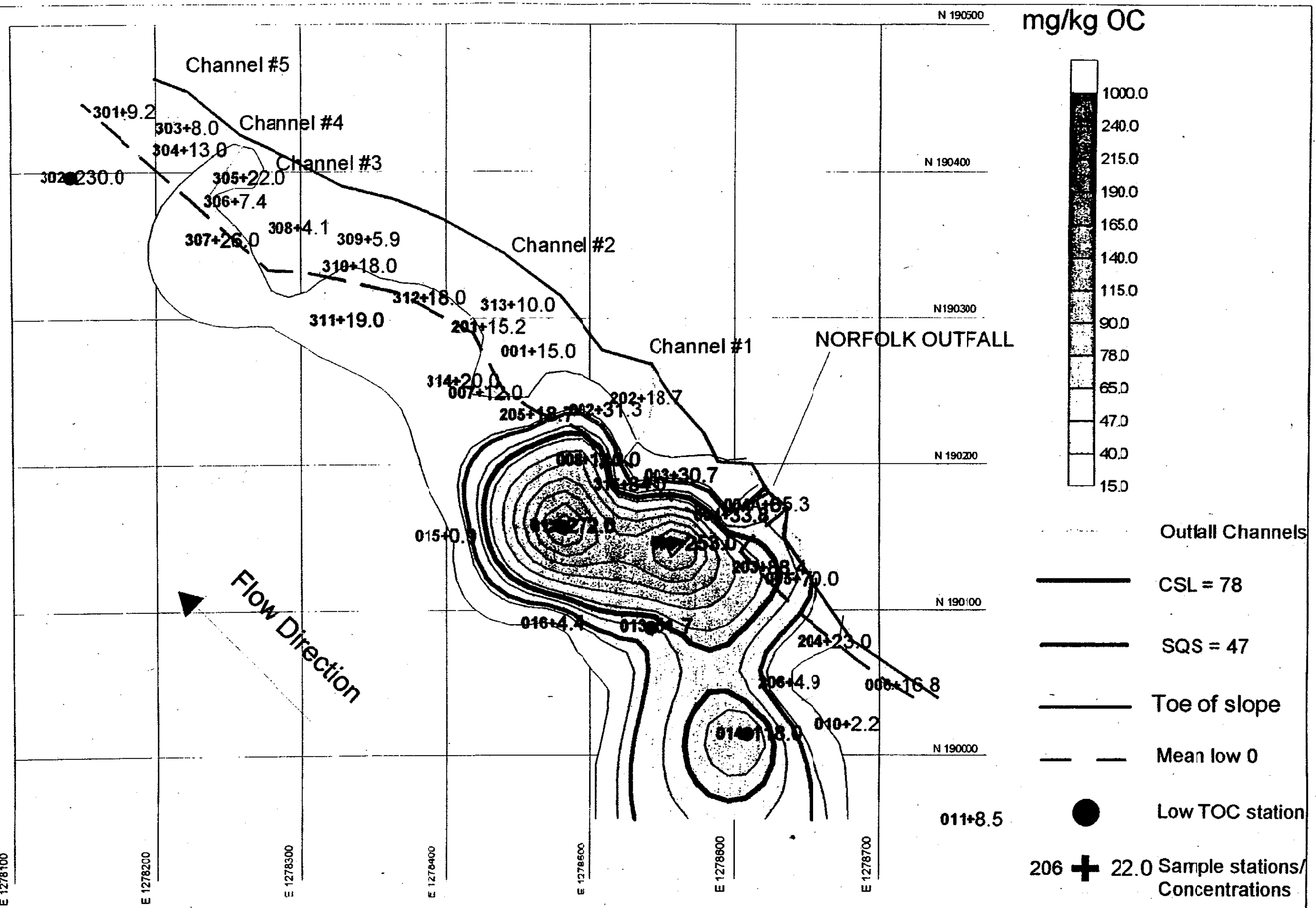
The main source of 1,4-dichlorobenzene to sewage appears to be toilet block deodorizers (Verschueren, 1983); therefore, source control (beyond controlling for the overflows) can be easily accomplished by removal of the toilet block deodorant. Similar to mercury, 1,4-dichlorobenzene serves as a useful marker of the extent of outfall-related sediment contamination, particularly for untreated discharges (Chapman et al, 1996). Once associated with sediments, 1,4-dichlorobenzene is persistent (Oliver and Nicol, 1982). In other studies, this COC has shown high correspondence with both toxicity and changes in benthic community structure, and the correspondence with toxicity increased when 1,4-dichlorobenzene was normalized to TOC (Chapman et al, 1996).

5.1.2.3 Bis (2-ethylhexyl) phthalate

Figure 5-3 illustrates the concentration contours for bis (2-ethylhexyl) phthalate in surface sediment. The surface pattern indicates large SQS and CSL exceedance contours in the vicinity of the Norfolk CSO outfall, with the downstream CSO footprint ending near station NFK205. However, it is apparent that inclusion of low TOC stations (NFK012, NFK013, and NFK014) has affected the concentration contours. Therefore, surface concentrations were also contoured on a dry weight basis (**Figure 5-4**). The dry weight contours indicate a more realistic picture of the Norfolk CSO footprint, with peak concentrations evident near the base of the outfall and at two downstream stations.

The total surface area exceeding SQS and CSL criteria was not estimated, due to the impact of low TOC stations on the generation of these contours. However, the total surface area exceeding LAET/2LAET values is combined with other COCs to define the total surface area exceedances (refer to **Chapter 5.1.2.5**). As indicated by Phase 2 coring data (**Chapter 4.5**), bis (2-ethylhexyl) phthalate exceeded SMS criteria below 2-foot depth at coring stations NFK009 and NFK207; however, the deeper core sections exhibited low TOC, and additional comparison to dry-weight LAET values showed no exceedances. At core station NFK009, the dry-weight concentration was greatest in the 0- to 1-foot core section (572 μg/kg), but decreased to less than 30 μg/kg below the 1-foot depth. At core station NFK207, the dry weight concentration was also greatest in the 0- to 1-foot core section (1440 μg/kg), but decreased to less than 25 μg/kg below the 2-foot depth. Therefore, depth of sediment contamination is assumed to be 2 feet.

Phthalates have been used as plasticizers since the 1930s, primarily for production of polyvinyl chloride and other polymers. They are also used in household products. Therefore, their distribution in the environment is widespread. Bis (2-ethylhexyl) phthalate strongly sorbs to sediment due to its low water solubility, and is relatively persistent in the environment. Source control, other than control of the overflow, may be difficult because of the widespread sources.



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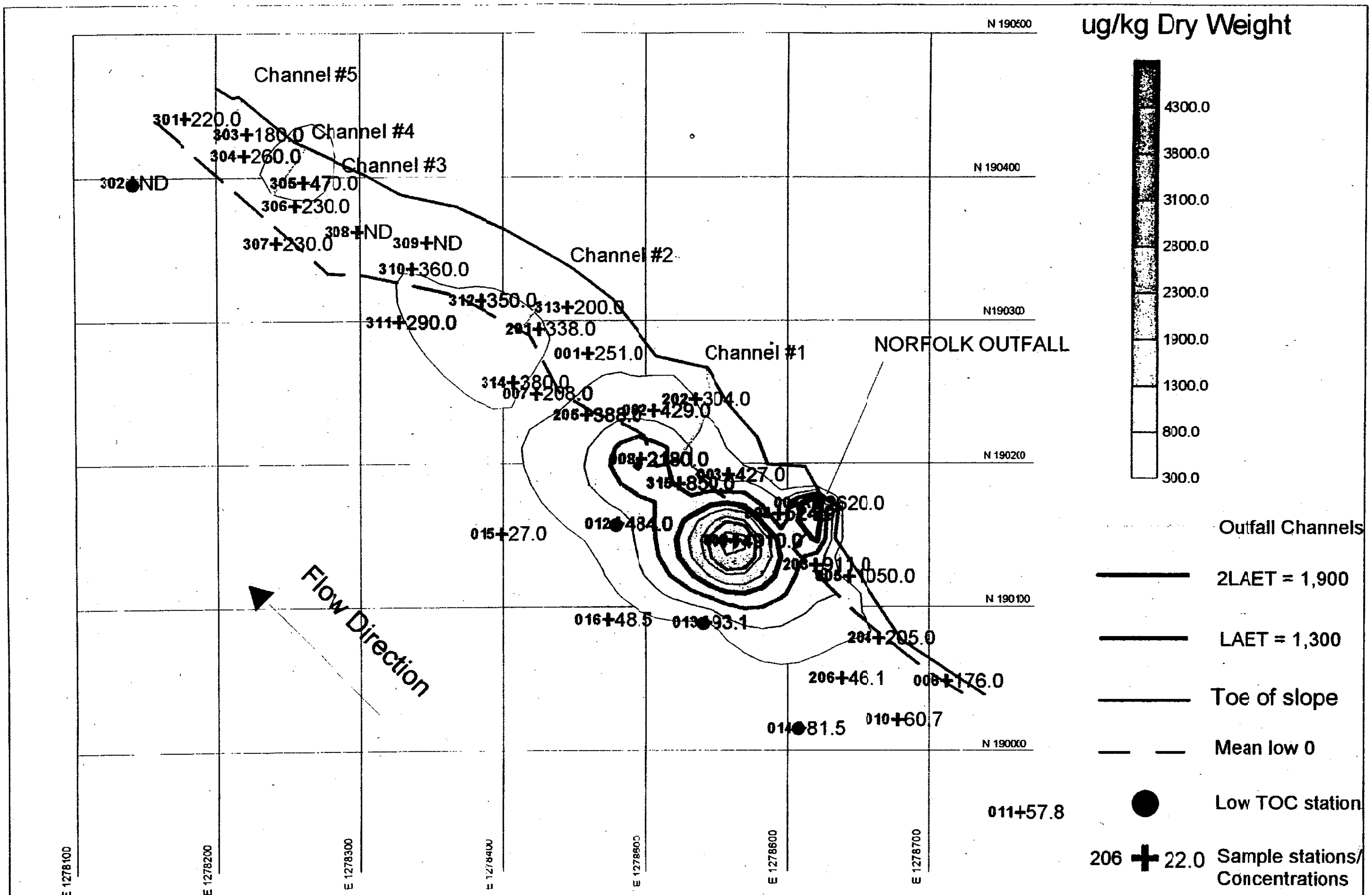
Norfolk Sediment Cleanup Study

Concentration Contours of Bis(2-EthylHexyl)Phthalate in surface sediments

Figure 5-3



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Norfolk Sediment Cleanup Study

Concentration Contours of Bis(2-EthylHexyl)Phthalate in surface sediments

Figure 5-4

5.1.2.4 PCBs

Figure 5-5 illustrates the concentration contours for total PCBs in surface sediment. The surface patterns are dominated by hotspots at station NFK315 (19,000 mg/kg OC),which is located at the channel mouth of Boeing Outfall #1, and at station NFK305 (10,400 mg/kg OC), which is located approximately 400 feet downstream of the Norfolk outfall. It is clear that the downstream PCB hotspot at NFK305 is unrelated to the Norfolk CSO outfall footprint. A third area of smaller PCB magnitude is located at station NFK201 (135mg/kg OC), which appears independent of the NFK305/315 hotspots.

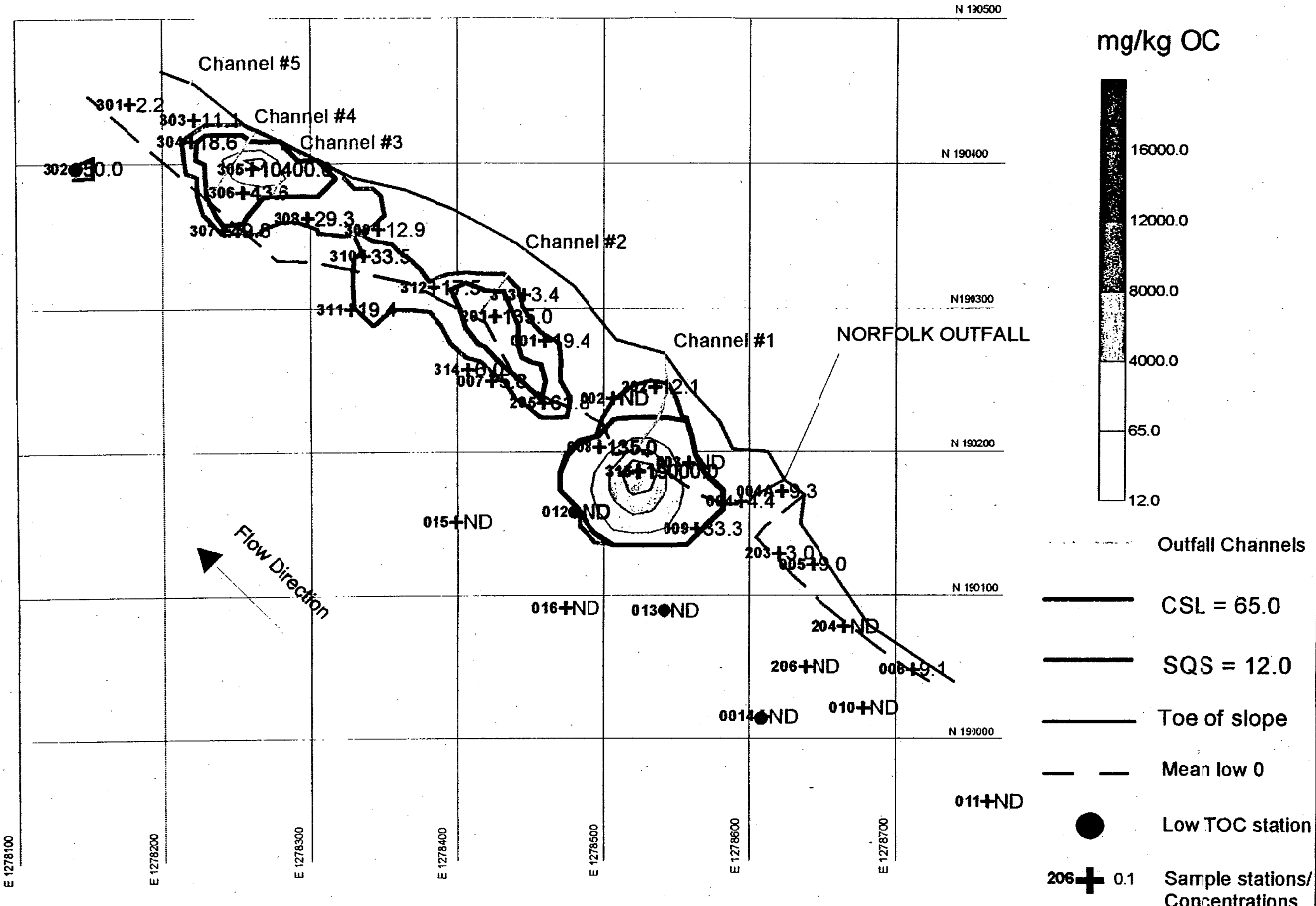
For the PCB hotspot at NFK315, the total surface area exceeding SQS/CSL criteria is combined with other COCs to define the total surface area exceedances (refer to **Chapter 5.1.2.5**). As indicated by Phase 2 coring data (**Chapter 4.5**), PCBs exceeded SMS criteria below 2-foot depth at core station NFK008 (located within 20 feet of the NFK315 hotspot); however, the deeper core sections exhibited low TOC, and additional comparison to dry-weight LAET values showed no exceedances. Dry weight concentrations at this core station were greatest between 1 to 2 feet (81,400 µg/kg), and decreased to less than 50 µg/kg below a 2-foot depth. Therefore, depth of sediment contamination is assumed to be 2 feet.

The concentration contours associated with the PCB hotspots at downstream stations NFK201 and NFK305 are not considered part of the Norfolk CSO footprint, and therefore associated surface area exceedences have not been included for these downstream locations.

Current uses of PCBs are restricted to insulating materials in electrical capacitors and certain transformers employed in enclosed areas. Historically, PCBs were used in hydraulic fluids, plasticizers in waxes, additives (in paints, adhesives, and caulking compounds), and components in paper manufacture (Mearns et.al., 1991). Sources of PCBs to aquatic environments include municipal sewage treatment plants, industrial runoff, leaching from disposal sites, and refuse incineration.

5.1.2.5 Total Cleanup Areas And Volumes Defined by Norfolk CSO Chemicals of Concern

The surface areas for SQS/CSL exceedances (or LAET/2LAET exceedances for bis (2-ethylhexyl) phthalate) determined by contour plotting were overlaid for the four COCs, and total surface areas that may require cleanup were estimated by Arcview GIS methods. Using this approach, the total surface area exceeding SQS criteria is estimated at 20,000 square feet, and the total surface area exceeding CSL criteria is estimated at 14,800 square feet (**Figure 5-6**). Assuming a 2-foot depth of contamination, total sediment volume exceeding SQS criteria is estimated at 1,481 cubic yards, and total sediment volume exceeding CSL criteria is estimated at 1,096 cubic yards. As indicated, these estimates include the PCB hot spot associated with Station NFK315, but exclude the PCB hot spots located further downstream and beyond the CSO footprint.



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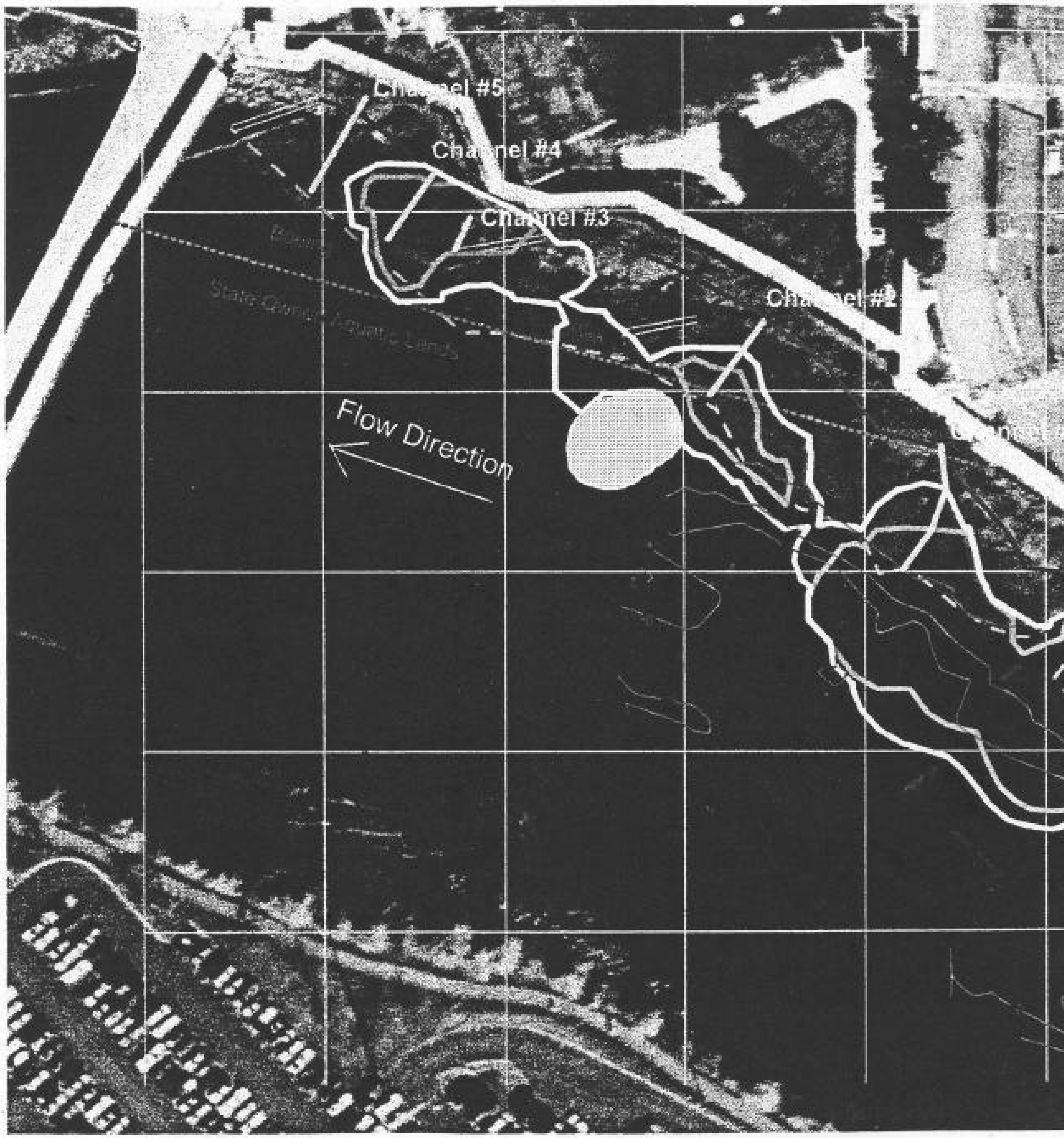
Norfolk Sediment Cleanup Study

Concentration Contours of Total PCBs in surface sediments

Figure 5-5



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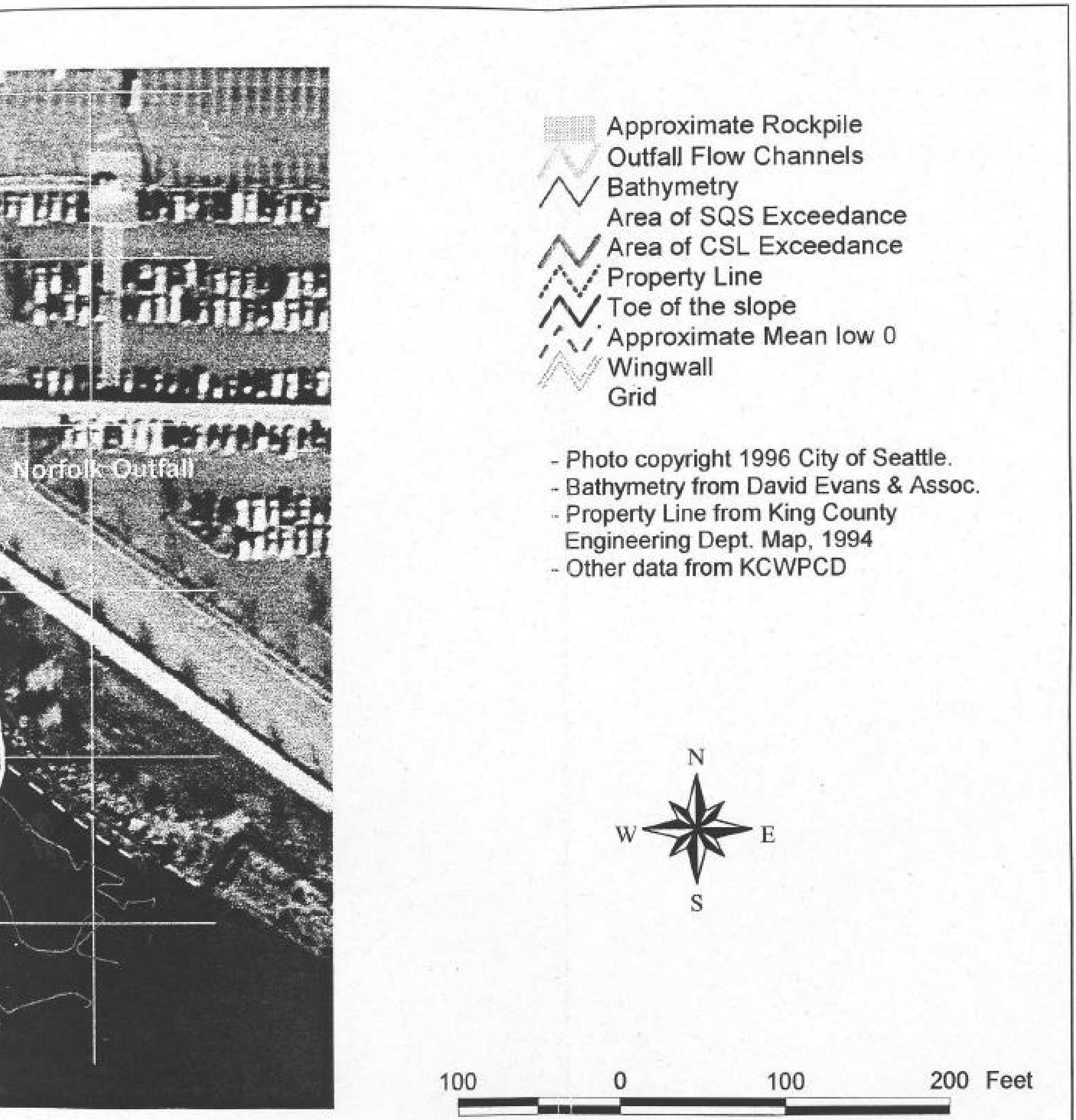

Cleanup Study	Figure 5-6
dance Boundaries	

5.1.3 Chemicals of Concern from Other Sources

The tabulated data and concentration contour maps do not indicate other source areas upgradient of the Norfolk outfall, with the exception of limited PAH exceedances of SQS criteria at station NFK006. This station is located approximately 140 feet upstream, and may be influenced by creosote from the adjacent wood barge; however, there is no data to confirm this. Further upstream, samples collected at the Duwamish reference stations (NFKUPRIV1, NFKUPRIV2) showed no exceedances of SMS criteria.

Potential downstream contaminant sources include storm drain discharges from the Boeing outfalls. The contour maps presented in this chapter generally indicate peak concentrations of the four COCs near the channel of the CSO outfall, followed by a second peak near the channel mouth of Boeing Outfall #1. For PCBs, the downstream hot spot at station NFK305 is located near the channel mouth of Boeing outfall #4. It is unknown whether these peak concentrations represent current or historical discharges to the river. Since the PCB hotspot areas appear independent, this cleanup study is strictly focused on those areas associated with the footprint of the Norfolk CSO outfall.

5.2 POTENTIAL FOR CONTAMINANT MIGRATION

The possible mechanisms for contaminant migration include (1) sediment erosion and subsequent resettling, (2) sediment reworking, including bioturbation, and (3) contaminant repartitioning to the water column.

The Duwamish River is generally a region of sedimentation. Sediment erosion could occur under extremely high river discharges (however, the river is regulated upstream by the Howard Hansen dam) or extreme tidal surges from Elliott Bay. Either of these condition is rare, and therefore the likelihood of sediment erosion and subsequent resettling is considered to be small.

It is certain that the sediment will be reworked to some extent by a number of processes including bioturbation and vessel wake turbulence. However, these processes will generally diffuse the contamination vertically through the sediment column, and thus will dilute sediment concentrations.

As the overlying water becomes cleaner, linear-isotherm partitioning suggests that some contamination will move from the sediment to the water column. This would tend to reduce sediment concentrations, and the flux to the water column would be flushed to Elliott Bay and quickly mixed below detection levels.

Overall, the potential for significant (sufficient to cause concern) sediment migration is considered to be small.

5.3 POTENTIAL FOR NATURAL RECOVERY

The mechanisms for natural recovery include (1) natural sedimentation and burial, (2) sediment reworking, and (3) contaminant repartitioning to the water column.

Natural sedimentation does occur in the Duwamish River, as the river velocities decrease where the river meets salt water, and the river widens. However, sedimentation rates are generally small, and natural recovery through this process would take a long time. As with natural sedimentation, sediment reworking through processes such as bioturbation and vessel wake turbulence is also a slow process.

Contaminant repartitioning to the overlying water column could occur if the water column concentrations were less than those estimated from equilibrium partitioning theory. In general, the flows from upstream are relatively clean, and once the Norfolk CSO discharge is controlled and other nearby sources are controlled, we would expect to see decreased ambient water column concentrations of the chemicals of concern. While this would result in decreasing contaminant concentrations in the sediment, the rate of recovery is uncertain, and would probably be slow because the organic contaminants of concern (e.g. PCBs) are strongly adsorbed to sediments. Modeling results indicate that sediment concentrations are reduced much more slowly in the absence of high sedimentation rates. At the Norfolk site, the net sedimentation rate appears to be low, based on the observation of little change in stakes left in the intertidal area for 2 years.

It is clear that as discharges are controlled and contaminant sources eliminated or reduced, natural recovery would occur. However, with the available information, it is not possible to predict how long this would take. It is likely that each of the processes reviewed would act slowly, and together they would still take considerable time to meet sediment quality standards.

5.4 POTENTIAL FOR SEDIMENT RECONTAMINATION

Sediment recontamination could potentially come from three sources: (1) the Norfolk CSO discharge, (2) from nearby sources within the tidal excursion range of the Norfolk discharge point (e.g., Boeing outfalls), and (3) from ambient concentrations carried by the Duwamish River.

The sediment recontamination modeling results indicate that discharges from the Norfolk outfall following CSO reductions should not cause sediment recontamination that would exceed the sediment quality standards. The model results indicate that the river mixing width required to meet sediment quality criteria is very small, and much smaller than the width of the area of observed contamination.

As previously discussed, the Boeing Company recently collected and tested sediment samples from the base of their downstream storm drain outfalls for PCBs, and results were generally nondetects (refer to **Chapter 3.1.2** and **Appendix F**). However, the tabulated data and concentration contours for the chemicals of concern indicates a possible association between the storm drains and elevated contaminant levels. Therefore, current findings cannot totally dismiss the Boeing outfalls as unlikely to cause sediment recontamination.

Finally, sediment sampling conducted upstream of the Norfolk CSO outfall show no significant concentrations of the chemicals of concern. Therefore, the overall potential for sediment recontamination following various levels of cleanup is considered to be small.

6.0 APPLICABLE LAWS AND REGULATIONS

6.1 IDENTIFICATION OF APPLICABLE LAWS AND REGULATIONS

This chapter presents the applicable laws and regulations which govern cleanup at the Norfolk site, and the cleanup standards which will be applied to site sediments based upon this review. Many federal, state, and local laws, regulations , and ordinances may affect the Norfolk sediment remediation project. Some of these programs directly address the management of contaminated materials, dredged material, or sediments. Other programs may impose requirements that impact the manner in which the sediment cleanup will be implemented.

The selection of the applicable laws and regulations depends on site characteristics and location, the remedial actions selected, the substances present at the site and the exposure pathways by which contaminants at the site may become a risk to human health or the environment.

6.1.1 Federal Laws and Regulations

6.1.1.1 Consent Decree No. C90-395 WD, U.S. District Court, Western District of Washington

Under its authority as a natural resource trustee provided by the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), the National Oceanic and Atmospheric Administration (NOAA) sued the City of Seattle and Metro (now KCWPCD) on March 19, 1990 to recover damages caused by the releases of hazardous substances discharged from their combined sewer overflows and storm drains located in the Duwamish River and Elliott Bay (EBDRP 1994a). Joining in this suit were other natural resource damage assessment (NRDA) trustees including U.S. Fish and Wildlife Service, Ecology, Muckleshoot Indian Tribe, and the Suquamish Indian Tribe. A Consent Decree (Consent Decree, 1991) was signed to settle the law suit which required the City and Metro to expend a total of $24 million for source control, remediation, and habitat restoration activities to mitigate the alleged damages. The remediation of the Norfolk site is being performed under the authority of the Consent Decree.

6.1.1.2 National Environmental Policy Act (NEPA) 42 USC, 4321 et seq. and 40 CFR 1500 et seq.

The National Environmental Policy Act (NEPA) was enacted in 1969 to establish a national policy for the protection of the environment. The Council on Environmental Quality (CEQ) was established to advise the President and to carry out certain other responsibilities relating to implementation of NEPA by federal agencies. Pursuant to Presidential Executive Order, federal agencies are obligated to comply with NEPA regulations adopted by the CEQ (40 CFR Parts 1500-1508). These regulations outline the responsibilities of federal agencies under NEPA and provide specific procedures for preparing environmental documentation to comply with NEPA.

NOAA, as the lead federal agency for the NEPA process, will prepare an Environmental Assessment (EA) and will publish it in the Federal Register. It is expected that the EA will result in a finding of no significant impact (FONSI).

6.1.1.3 Resource Conservation and Recovery Act, 42 USC 6901 and 40 CFR 260 et seq.

RCRA was enacted to regulate the management of hazardous waste, to ensure the safe treatment, storage, and disposal of wastes, and to provide for resource recovery from the environment by controlling hazardous wastes "from cradle to grave". Because the state has been authorized to implement both Subtitles C and D of RCRA, the only regulations under the federal program would be those developed under the Hazardous and Solid Waste Act (HSWA) amendments for which EPA has not delegated regulatory authority to the state (e.g., land disposal restrictions). RCRA Subtitles C and D and 40 CFR 268 are applicable for upland disposal options of dredge sediments.

6.1.1.4 Clean Water Act, 33 USC 1251 et seq. and Federally Promulgated Water Quality Standards, 40 CFR 131

The Clean Water Act (CWA) requires the establishment of guidelines and standards to control the direct or indirect discharge of pollutants to waters of the United States. Effluent limitations developed for the regulated pollutants are applied to point source discharges on a case-by-case basis.

Section 304 of the CWA (33 USC 1314) requires EPA to publish Water Quality Criteria, which are developed for the protection of human health and aquatic life. These water quality criteria are promulgated in 40 CFR 131, which is also referred to as the National Toxics Rule (NTR). Federal water quality criteria are used by states to set water quality standards for surface water.

Discharges of material into navigable waters are regulated under Sections 401 and 404 of the CWA (33 USC 1341 and 1344), 40 CFR 230 (Section 404(b)(1) guidelines), 33 CFR 320 (general policies), 323 and 325 (permit requirements), and 328 (definition of waters of the United States). These requirements regulate the discharge of dredged or fill material to navigable waters of the United States. The ACOE has the primary responsibility for administering the Section 404 permit program. Section 401 requires state water quality certification before 404 permits can be issued. This allows states to veto a permit application for non-compliance with state and local water quality laws or to request the ACOE to place conditions on the 404 permit.

6.1.1.5 Rivers and Harbors Act, 33 USC 403 and 40 CFR 320, 323

This Act prohibits unauthorized activities that obstruct or alter a navigable waterway. In particular, Section 10 of the Act applies to any dredging and/or disposal activity in navigable waters of the United States, including the Duwamish River. Therefore, the Rivers and Harbors Act is applicable to the Norfolk site.

U.S. Army Corps of Engineers (ACOE) permits are needed for the discharge of dredge or fill material into waters of the United States. There are general permits which include regional permits issued by district or divisional engineers on a regional basis and nationwide permits which are issued by the Chief of Engineers. If the activity is not covered by a general permit, an individual permit application must be filed. The Secretary of the Army acting through the Chief of Engineers authorizes the permit. Several policies are applicable to the review of permit applications which include: public interest review; effect on wetlands; fish and wildlife; water quality; historic, cultural, scenic and recreational values; effects on limits of the territorial sea; consideration of property ownership; other federal, state, or local requirements; safety impoundment and structures; water resource values; water supply and conservation; navigation; and mitigation. The public interest review involves the evaluation of probable impacts, including cumulative impacts, of the proposed activity and its intended use of the public interest. In turn, this evaluation is based on a balancing of the benefits of the proposal against its reasonably foreseeable detriments. The criteria used for this evaluation are outlined in 40 CFR 320.4.

6.1.1.6 Toxic Substances Control Act, 15 USC 2600 et seq. and 40 CFR 760 et seq.

TSCA authorizes the EPA to establish regulations pertaining to the control of chemical substances or mixtures that pose imminent hazards. EPA has published regulations pertaining to, among other chemicals, PCBs. 40 CFR 761 Subpart D regulates the storage and disposal of PCBs including soils and sediments excavated from regulated units which have PCB concentrations greater than 50 mg/kg DW. PCB-contaminated materials at these concentrations must be incinerated or disposed of in a qualifying chemical waste landfill. PCB-contaminated liquids may alternatively be disposed of in high efficiency boilers which meet specific criteria.

PCBs have been detected in two different hot spots at the Norfolk site at concentrations greater than the 50 mg/kg threshold. If sediments are removed from the site with concentrations greater than 50 mg/kg, then TSCA will be appropriately applied.

6.1.1.7 Comprehensive Environmental Response, Compensation and Liability Act, 42 USC 9601 and National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR 300

CERCLA, also known as Superfund, and the NCP provide the national policy and procedures to identify and cleanup contaminated sites on the National Priority List (NPL). The Norfolk site is not an NPL site, nor is it being considered for the NPL. CERCLA also provides for natural resource trustees to assess and seek compensation for damages to natural resources resulting from releases of hazardous materials (42 USC 9607). The Consent Decree (Section 6.1.1.1) was filed under the authority of CERCLA.

6.1.2 State Laws and Regulations

6.1.2.1 Sediment Management Standards, Chapter 173-204 WAC

The Sediment Management Standards (SMS) (Chapter 173-204 Washington Administrative Code (WAC)) regulations are promulgated under the Water Pollution Control Act (Chapter 90.48 Revised Code of Washington (RCW)), Model Toxics Control Act (MTCA) (Chapter 90.105D RCW), and the Puget Sound Water Quality Authority Act (Chapter 90.52 RCW) to establish marine, low salinity and freshwater surface sediment standards for Washington state. To date, only marine sediment standards for Puget Sound have been established. Marine sediments are defined as those sediments in which the interstitial pore water contains 25 parts per thousand (ppt) salinity or greater.

The SMS relies on chemical and biological criteria to designate sediments. Most of the chemical criteria are derived from the apparent effects threshold (AET) method, an empirical method based on Puget Sound chemistry and biological effects data. Chemical criteria are established for a "no adverse effect" level (or SQS) and a "minor adverse effect" level (or CSL/MCUL). The SMS regulations recognize that a cleanup action may not achieve the objective of no adverse effects initially; therefore, minimum cleanup levels were established. These cleanup levels are the maximum allowed chemical concentration and level of biological effects permissible at the site that are expected to result in no adverse effects by year ten after completion of the active cleanup action. These regulations are applicable and shall be used to determine the sediment standards for the Norfolk site.

6.1.2.2 Shoreline Management Act, Chapter 90.58 RCW and Chapter 173-14 WAC

The regulations in Chapter 173-14 WAC were developed pursuant to Chapter 90.58 RCW to protect shoreline values while still fostering reasonable use. These regulations require substantial development permits to be obtained for any project or action which occurs within 200 feet of the ordinary high water mark of marine waters and materially interferes with the normal public use of the water or shorelines of the state. The local government (City of Tukwila Planning Division) issues substantial development permits (**Chapter 6.1.3.1**). The Washington State Department of Ecology (Ecology) and the Attorney General are sent copies of the permit by the local government for review. Since they do not have permit approval authority, they may request review of the permit by the Shorelines Hearings Board if they are dissatisfied with the permit. The average time for approval of a substantial development permit application is approximately 4 to 12 months. Two other permits, a conditional use permit and a variance permit, may also be issued. A conditional use permit is designed to allow greater flexibility in varying the application of land use activities. A variance permit grants relief in extraordinary or unique circumstances from "specific bulk, dimensional, or performance standards" of master programs. These two permits need to be granted by the local planning department and Ecology. It is not anticipated that remedial activities at the Norfolk site will deviate from the goals of the King County Shoreline Master Program. Therefore, it is anticipated that only a substantial use permit will be required for the Norfolk site.

6.1.2.3 Puget Sound Estuary Program

The Puget Sound Estuary Program (PSEP) was established in 1987 under the authority of the National Estuary Program (NEP), Section 320 of the Clean Water Act (33 USC 1330). The NEP was established to protect estuaries of national significance by requiring a management conference to develop a comprehensive management plan for the estuary. PSEP is jointly managed by the U.S. Environmental Protection Agency (EPA), Ecology and the Puget Sound Water Quality Authority (PSWQA) in cooperation with federally recognized Native American Indian tribes of western Washington. The PSWQA authored the *1991 Puget Sound Water Quality Management Plan* (PSWQA, 1991), which was adopted by EPA as the Puget Sound Comprehensive Conservation and Management Plan. Action plans within the Plan which are applicable to the Norfolk site include the Contaminated Sediment and Dredging action plan, the Municipal and Industrial Discharges action plan and the Stormwater and Combined Sewer Overflows action plan. Under Chapter 70.90 RCW, PSWQA, state agencies and local governments are required to "evaluate and incorporate as applicable, subject to the availability of appropriated funds or other funding sources, the provisions of the Plan, including any guidelines, standards and timetables contained in the Plan." Therefore, the Plan does not have specific regulatory force but must be considered during actions which are covered by the Plan. Thus, the Plan shall be considered as guidance. Under PSEP, *Puget Sound Protocols* were developed to standardize the collection and analysis methods used for chemical and biological testing in Puget Sound. The use of standardized protocols by all agencies, consultants, and investigators continues to increase the usefulness of the information collected by allowing comparisons with other data collected using similar methods. The protocols are updated periodically as advances in technology and changes in needs are identified or warranted.

6.1.2.4 State Environmental Policy Act, Chapter 43,21C RCW and Chapter 197-11 WAC

The State Environmental Policy Act (SEPA), Chapter 43.21C RCW, sets forth the state's policy for protection and preservation of the natural environment. Chapter 197-11 WAC are the state's rules to implement this act. Local jurisdictions must also implement the policies and procedures of SEPA. Ecology, the SEPA lead agency, will submit the state's response to the NEPA EA, (**Chapter 6.1.1.2**), for the Norfolk site. After a FONSI is issued, if applicable, the state lead will adopt the federal document. This adoption is necessary prior to the issuance of most of the other permits needed to conduct remedial activities at the Norfolk site.

6.1.2.5 Historic Preservation Act, Chapter 27.34 RCW, Chapter 27.44 RCW, and Chapter 27.53 RCW

These acts prohibit disturbing any Native American grave sites or other historical or prehistorical archeological resources without a permit or supervision from the proper department or tribes. Because the Norfolk site is located in the native bed of the Duwamish River, it is not expected that any historic or prehistoric remains will be encountered. If any article is uncovered, these requirements will apply, and the Suquamish Tribe and the Muckleshoot Indian tribe, as federally recognized tribes of interest, will be consulted.

6.1.2.6 Washington Dangerous Waste Regulations, Chapter 70.105 RCW and Chapter 173-303 WAC

The regulations found in Chapter 173-303 WAC were developed to implement Chapter 70.105 RCW and are based on the state's authority to administer RCRA. The Dangerous Waste Regulations provide criteria for determining whether solid wastes which are removed during remediation are dangerous or extremely hazardous. These regulations also provide rules which apply to the generators of hazardous substances and the treatment, manifesting, transporting, disposal and storage of these substances. Removing contaminated sediments from the river constitutes generating such substances. If sufficient quantities of hazardous substances are removed such that the small quantity exemption does not apply, then these regulations will potentially be used for the dredged sediments.

6.1.2.7 *Washington Hydraulic Code, Chapter 75.20 RCW and Chapter 220-110 WAC*

This act establishes requirements for performing work that would use, divert, obstruct, or change the natural flow or bed of any salt or fresh waters and sets forth procedures for obtaining hydraulic project approval. For the Norfolk site, the Washington State Department of Fish and Wildlife would review the proposed hydraulic project for approval. Submittal for review includes general plans for the overall project and complete plans and specifications for the proposed construction or work below the old high waterline of state waters and for the proper protection of fish life. The proposed project will be either approved or denied within 45 calendar days of the receipt of a complete application and notice of compliance with applicable requirements of SEPA. If the Department of Fish and Wildlife believes that the proposed project will either directly or indirectly harm fish life, the project will be denied unless adequate mitigation can be assured by conditioning the approval or modifying the proposal. The provisions of WAC 220-110-270 and -320 are applicable for the Norfolk site.

6.1.2.8 *NPDES Permit Program, 33 USC 1251, 40 CFR 123, Chapter 90.48 RCW and Chapter 173-220 WAC*

Section 402 of the Clean Water Act (33 USC 1251) requires EPA to issue permits for the discharge of any pollutant to navigable waters. Federal regulations (40 CFR 123) allow qualifying states to issue NPDES permits. Washington's Water Pollution Control Law (Chapter 90.58 RCW) and regulations (Chapter 173-220 WAC) meet the federal requirements for the state to issue NPDES permits. Water from dewatering activities associated with dredged sediments released to the Duwamish River would be regulated under an NPDES permit. However, water from such activity could be released to a sanitary sewer which would not require an NPDES permit but rather, approval from KCWPCD.

6.1.2.9 *Water Quality Standards for the Surface Waters of the State of Washington, Chapter 90.48 RCW and Chapter 173-201A WAC*

These regulations establish water quality standards for the surface waters of the state as required by the Clean Water Act and the Water Pollution Control Act (Chapter 90.48 RCW). Specific standards apply for many toxic substances. These surface water quality standards will be applied during all remedial activities, as applicable.

6.1.2.10 *Model Toxics Control Act, Chapter 70.105D RCW and Chapter 173-340 WAC*

The statute, Chapter 70.105D RCW, was created as a result of citizens' initiative Measure No. 97. MTCA requires Ecology to establish and periodically update minimum cleanup standards for hazardous substances, and investigate and remediate releases or threatened releases of hazardous substances.

The regulation, Chapter 173-340 WAC, promulgated under MTCA, establishes administrative processes and standards to identify, investigate, and cleanup facilities where hazardous substances pose a threat to human health and the environment. This regulation will be considered for the Norfolk site though it is not an official MTCA site.

6.1.2.11 Solid Waste Management Act, Chapter 70.95 RCW and Chapter 173-304 WAC

The Solid Waste Management Act provides the State's policy on landfill and solid waste disposal requirements. The policy places emphasis on Washington's dedication to recycling. This act and implementing regulations will be used when considering upland disposal remediation alternatives. Waste reduction and recycling will be considered wherever appropriate.

6.1.2.12 State Aquatic Lands Management, Chapter 79.90 RCW and Chapter 332-30 WAC

Land use authorizations of state owned aquatic lands are administered by the Department of Natural Resources (DNR). These areas include constitutionally established harbors, state tidelands, shorelands and the beds of navigable waters. Issuance of land use authorization for activities on these public lands is based upon evaluation of the proposed use by the department's Aquatic Lands Division. State law Chapter 79.90 RCW empowers DNR to set the terms and conditions to authorize uses of state owned aquatic lands. All the DNR's aquatic land use authorizations are contractual in nature and involve limited conveyances of rights to use state owned aquatic lands. The primary administrative rule on aquatic lands that guides the DNR is Chapter 332-30 WAC, Aquatic Lands Management, which established performance standards and operational procedures for aquatic lands uses.

6.1.3 Local Laws and Regulations

6.1.3.1 Shoreline Master Program, Title 25 King County Code

The City of Tukwila recently annexed the portion of King county which includes the site. The City will issue the Shoreline permit; however, until the Shoreline Master Program is modified (expected in 1997), the King County Shoreline Master Program (Title 25 King County Code) is the governing regulation. The Shoreline Master Program's overall goals are regulating development of shorelines to protect the ecosystem, provide maximum public use, encourage water dependent use, and preserve and increase views and access. The Shoreline Master Program provides standards for dredging and dredge disposal operations including shoreline fills. The Master Program will be considered in the decision making process during all phases of remediation.

6.1.4 Tribal Treaties

6.1.4.1 Treaty of Point Elliott, 12 Statute 927

The Treaty of Point Elliott was signed with Native American tribes occupying the lands within the Puget Sound Basin lying north of Point Pulley to the Canadian border and from the summit of the Cascade Mountains to the divide between Hood Canal and Puget Sound. The treaty guarantees "the right of taking fish at usual and accustomed grounds and stations ..." to all the signatory tribes and other allied and subordinate tribes and bands of Native American Indians. The Duwamish River is a usual and accustomed fishing area. This treaty is applicable, and will be observed to ensure that cleanup activities do not interfere with the rights of the tribes.

6.2 CLEANUP STANDARDS

In the 1991 Consent Decree agreement, the EBDRP Panel was directed to follow Washington state sediment standards as a minimum standard to determine the level of sediment cleanup. Therefore, identification of contaminated sediments was based on comparison to Washington State Sediment Management Standards (Chapter 173-204 WAC). The SMS have established cleanup standards for chemicals in marine sediments, while cleanup standards for low salinity sediments, freshwater sediments, and protection of human health are to be determined on a case-by-case basis. As discussed in **Chapter 4**, Phase 1 salinity data for surface sediments ranged from 14 to 22 ppt for upriver stations, and from 5 to 16 ppt for stations adjacent to or directly downstream of the Norfolk outfall. The decreased salinity at the outfall relative to the upstream locations is caused by low-salinity stormwater coming from the outfall. Since salinity measurements tended more towards marine designation, and field observations also indicated representative marine biota near the study area (e.g., presence of saltmarsh vegetation, intertidal barnacles, gammarid amphipods, and blue mussels), comparison to SMS criteria for marine sediments is considered appropriate for development of sediment cleanup areas.

The SMS marine chemical criteria for aquatic life are defined for two effects levels: a) Sediment Quality Standards (SQS) criteria, which establishes a level that will result in no adverse effects on biological resources; and 2) Cleanup Screening Level (CSL) criteria, which establish minor adverse effects levels and Minimum Cleanup Levels (MCULs) to be used in evaluation of cleanup alternatives. The site assessment identified four chemicals of concern (i.e., mercury, 1,4-dichlorobenzene, bis(2-ethylhexyl) phthalate, and PCBs) associated with the Norfolk outfall, based on comparison to respective SQS and CSL/MCUL criteria. These criteria are listed in **Table 6-1**; in addition, dry weight AET values are also listed for bis (2-ethylhexyl) phthalate, since dry weight comparisons were used to define the areal extent of contamination.

Table 6-1
POTENTIAL SEDIMENT CLEANUP STANDARDS FOR NORFOLK CHEMICALS OF CONCERN

Chemical of Concern	SQS Criteria	CSL(MCUL) Criteria	LAET Value
Mercury	0.41 mg/kg DW	0.59 mg/kg DW	
1,4-Dichlorobenzene	3.1 mg/kg OC	9 mg/kg OC	
Bis(2-ethylhexyl) phthalate	47 mg/kg OC	78 mg/kg OC	1,300 ug/kg DW
Total PCBs	12 mg/kg OC	65 mg/kg OC	

Notes:
SQS: Sediment Quality Standard
MCUL: Minimum Cleanup Level
OC: Organic Carbon
CSL: Cleanup Screening Level
LAET: Lowest Apparent Effects Threshold
DW: Dry weight

The SMS provides for site-specific cleanup standards that may range from SQS to CSL/MCUL criteria, based on evaluation of associated cost and net environmental benefits. In addition, human health risks may be considered for bioaccumulative chemicals such as PCBs. As part of the site assessment, potential sediment cleanup areas were estimated, by calculating the surface area exceeding SQS <u>and</u> CSL/MCUL criteria for each of the chemicals of concern. [Note:

sediment surface area exceedances for bis(2-ethylhexyl) phthalate were based on comparison to dry weight AET values, rather than organic carbon-normalized SQS/CSL criteria, since several low TOC stations affected the contouring of organic carbon normalized concentrations.] Individual chemical exceedance areas were then combined, yielding a total volume of sediments exceeding SQS and CSL criteria (or AET values for bis (2-ethylhexyl) phthalate) for the outfall footprint of 1,481 and 1,096 cubic yards, respectively. This assumes a 2-foot depth of contamination, consistent with the findings of the site assessment.

Following completion of the site assessment, several members of the EBDRP Panel became involved in interagency discussions regarding the potential for human health risks from PCBs in Duwamish River sediments, at this and other sites. As a result of these discussions, it became apparent that human health risks due to bioaccumulation of PCBs in seafoods, as well as adverse effects on juvenile salmonids migrating through the Duwamish River estuary, may occur at levels below the SQS. However, human health-based sediment standards have not yet been promulgated, nor have bioaccumulation-based site-specific standards been set for PCBs at any site. Plans are in place to develop such standards for sites in the Duwamish River, but these studies are not yet complete and are beyond the scope and schedule of this relatively small and routine cleanup.

In order to address these concerns, the EBDRP Panel decided, as part of the planned cleanup at Norfolk, to remediate any additional, accessible sediments below SQS that contain detected levels of PCBs. The Panel believes that the benefits of achieving protection of human health and migrating juvenile salmonids outweighs the small additional cost of remediating these sediments. The extended sediment remediation area (**Figure 6-1**) is based on extending the PCB cleanup to nondetect levels. The calculated surface area for this sediment cleanup area is 32,300 square feet, and the estimated sediment cleanup volume is 2,392 cubic yards (assuming a 2-foot depth of contamination).

Although the remedial action is planned to address these additional sediments, the site-specific cleanup standards will be set at SQS. Without the detailed studies planned to be carried out over the next few years in the Duwamish, it is not yet appropriate to select a site-specific sediment standard that is protective of bioaccumulative effects of PCBs. Selection of the SQS as the long-term standard for all chemicals at the site is also consistent with the goals of the sediment source control program. This is appropriate because this site contains an operating CSO under an NPDES permit, and the NPDES program will be responsible for monitoring the area once the cleanup is completed.

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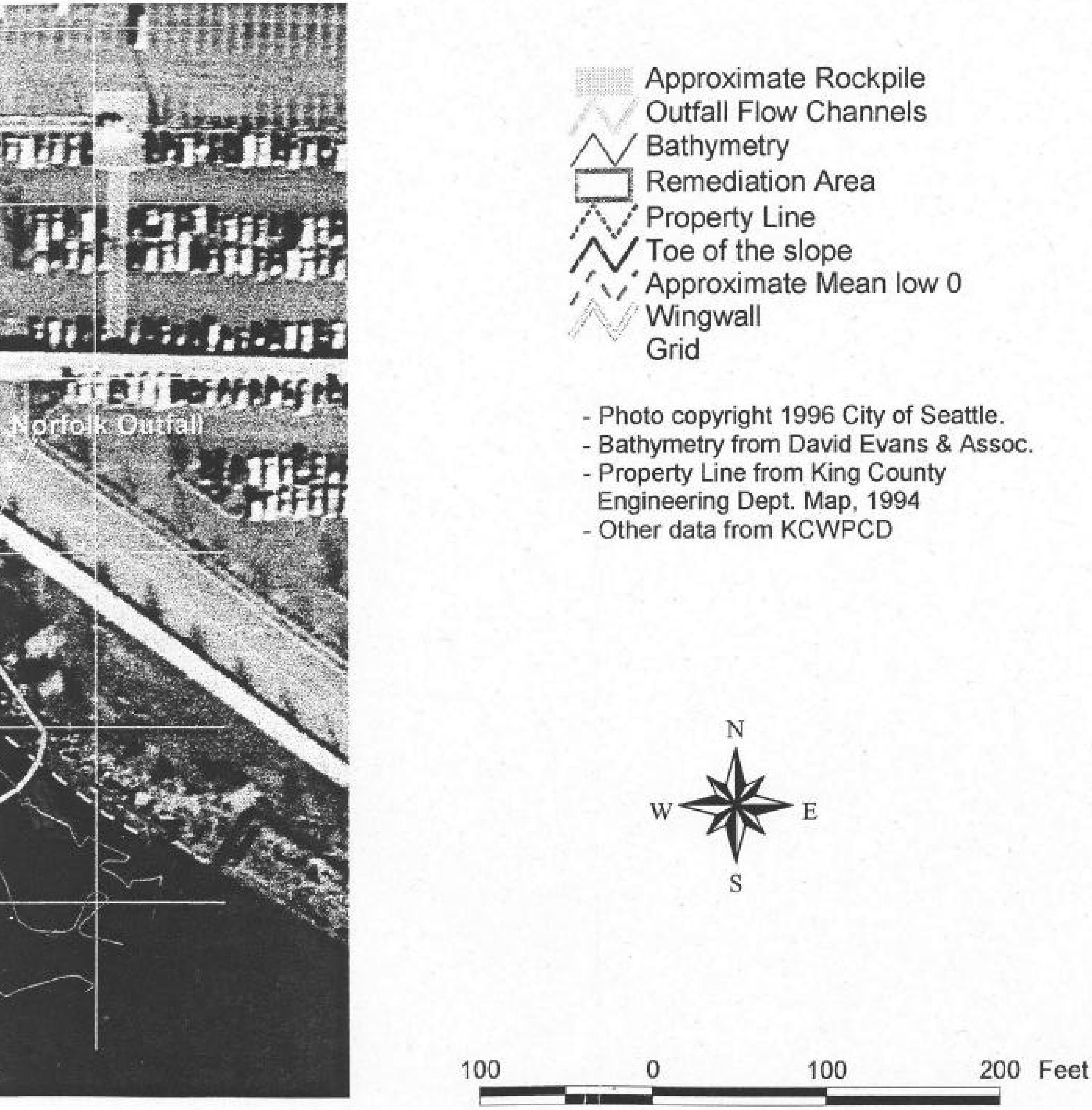

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- Other data from KCWPCD

Cleanup Study	Figure 6-1
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